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**BABCOCK INSTITUTE DISCUSSION PAPER
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THE DAIRY SECTOR OF BRAZIL: A COUNTRY STUDY

William D. Dobson, Edward V. Jesse and Ronaldo Braga Reis

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THE DAIRY SECTOR OF BRAZIL: A COUNTRY STUDY

William D. Dobson, Edward V. Jesse and Ronaldo Braga Reis¹

EXECUTIVE SUMMARY

Brazil is a large country with a very strong agricultural resource base. It is one of the world's largest exporters of agricultural, forestry, and fishery products, trailing only the European Union and the United States in agricultural export value. Brazil utilizes less than half of its arable land for farming. Yet until very recently, Brazil's milk production had fallen short of domestic consumption, resulting in large net imports of dairy products. This is in contrast to Brazil's neighbors, Uruguay and Argentina, which have traditionally been large net exporters of dairy products.

Recent growth in Brazilian milk production and exports suggests the possibility of a larger role for Brazil in world dairy markets. We evaluated conditions in the production sector, the processing sector and the government policy environment in an attempt to shed more light on this possibility.

Brazil is home to more than one million dairy farmers. A large majority of them have small herds of low-yielding dairy-beef cows and supply milk only to their families and the informal market. However, there is a progressive core of more than 100,000 dairy farmers who supply most of the milk processed by licensed processors.

Brazil milk production costs are low compared to most developed countries, largely because most dairy farms employ some form of pasture-based production system. For farms that supplement grazing, sugarcane is an inexpensive source of green-chopped forage and citrus pulp is a readily-available energy feed. Animal health and dairy supply support services are adequate, but extension technical/management support is inconsistent and uncoordinated.

Recent strong milk prices have spurred growth in milk production, encouraging investments in larger, modern dairy facilities and yield-enhancing genetic and technical improvements. If these incentives continue, we expect continued growth in milk production at an annual rate of about 4 percent.

Brazil's dairy processing sector is undergoing major structural change. Concentration is increasing, accelerated by the recent entry of two large Brazilian meat packing companies into dairy. But there are still more than 1,100 dairy processing plants in Brazil, most of which handle less than 10,000 liters per day—about the daily production of a well-managed 400-cow Wisconsin dairy farm. Most of these smaller processors are multi-service local cooperatives.

Several Brazilian firms and major multi-national firms operating in Brazil have the experience and exporting networks needed to expand dairy exports, if warranted by profitability and if a sufficient supply of exportable surplus milk is available. A significant constraint to expanded exports is Brazil's strong currency, and it is unclear that the Brazilian real will weaken substantially against other currencies anytime soon.

Government support for Brazilian agriculture in general and the dairy sector specifically is very low by developed country standards. Milk prices in Brazil were decontrolled in the early 1990s. Besides restrictions on subsidized dairy imports and some purchases of dairy products for distribution to the poor, government assistance is largely limited to credit guarantees and subsidized interest rates for specified farm- and plant-level investments and for broader infrastructure development projects to improve transportation. But, while special interest rates are lower than commercial rates in Brazil, they are still high by U.S. standards, and infrastructure development does not seem to be proceeding at a rapid pace.

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With regard to trade policy, Brazil is a charter member of the Cairns Group, an aggressive free trade advocate in multilateral negotiations. Brazil has used the WTO dispute resolution mechanism effectively in challenging implicit export subsidies and trade-distorting domestic support programs. Expanding exports by increasing market access is an unambiguous government objective.

Brazil's future role as a dairy exporter will depend at least as much on internal demand as on supply. Brazil's per capita milk consumption is less than one-half of the U.S. level. Despite culture-related dietary preferences that have limited consumption of dairy products in the past, rising Brazilian incomes will promote higher per capita usage. Plus, Brazil's population will likely continue to grow at about a 1 percent annual rate. With more people consuming more dairy products, much of any increase in Brazil's milk production will be needed to meet increasing domestic needs.

Nevertheless, our bottom line forecast is that growth in Brazilian milk production will outpace growth in domestic consumption. Dairy exports will continue to grow, probably to around four million tons milk equivalent by 2015. This would significantly elevate its standing among leading dairy exporting countries.

I. INTRODUCTION

The Babcock Institute for International Dairy Research and Development began dairy “Country Study” projects in 2004. These comprehensive studies summarize information relating to the competitiveness and likely future strategies of selected foreign dairy producers, processors, exporters and government agencies. This information is intended to help U.S. firms and policymakers develop appropriate strategies and policies to exploit export opportunities and to accommodate the actions of foreign dairy companies and foreign governments in exporting countries. The studies are conducted by teams of University of Wisconsin-Madison faculty and staff representing the fields of dairy production and management, dairy food processing, dairy marketing and trade, and strategic behavior. As part of the studies, the teams visit the study countries to obtain first-hand insights from industry participants, government officials and others.

Previous Babcock country/regional studies and related Babcock Discussion Papers were: Oceania (2004), Babcock Institute Discussion Paper No. 2004-3, The Dairy Sectors of New Zealand and Australia: A Regional Study; Poland (2005), Babcock Institute Discussion Paper No. 2005-3, The Dairy Sector of Poland: A Country Study; India (2006), Babcock Institute Discussion Paper No. 2006-2, The Dairy Sector of India: A Country Study; and Ireland (2007), Babcock Institute Discussion Paper No. 2007-2, The Dairy Sector of Ireland: A Country Study. These reports can be downloaded from the Babcock Institute web site: <http://babcock.cals.wisc.edu/publications/disc.lasso>.

Brazil was selected for the 2008 country study. Brazil is a major dairy country that has moved from being a significant importer to a net exporter of dairy products. International dairy analysts have identified Brazil as a country that could become an even larger dairy exporter in the relatively near future. However, these same analysts have noted that the future of Brazil’s dairy industry is among the most uncertain. This uncertainty has increased with the recent government incentives worldwide to produce crop-based transportation fuels. Brazil enjoys a large comparative advantage in producing sugar cane-based ethanol, and competition for land between growing feed and fuel will likely increase. This study takes a closer look at

Brazil’s dairy industry in light of recent developments, with an eye to assessing its growth prospects and the implications of developments in Brazil’s dairy industry for the U.S. and global dairy industries.

Because of budget constraints, the Brazil dairy study team consisted of only two University of Wisconsin members: William D. Dobson is an emeritus professor in the Department of Agricultural and Applied Economics and an agribusiness economist with the Babcock Institute. Professor Dobson’s expertise is international agricultural trade, agribusiness management, and macroeconomics. Edward V. Jesse is a professor and Extension dairy marketing and policy specialist in the Department of Agricultural and Applied Economics at the University of Wisconsin-Madison and director of trade and policy studies for the Babcock Institute. Professor Jesse’s expertise is dairy farm management and dairy marketing and trade. The Brazilian member of the team was Ronaldo Braga Reis, a professor in the School of Veterinary Medicine, Federal University of Minas Gerais. Professor Reis’ expertise includes animal health maintenance and dairy herd management.

Following an extensive review of print materials and internet sites, the team conducted on-site interviews arranged by Professor Reis in June 2008. We interviewed individuals and groups representing a broad spectrum of Brazil’s dairy sector, including dairy farmers, dairy processor executives, feed dealers, trade association leaders, government officials and academicians.

Throughout our literature review and personal interviews, we focused on a central theme: the potential for Brazil to become a major player in international dairy markets. Specific related questions included:

- What are likely trends in Brazil’s milk cow numbers and milk yield per cow?
- What will it require for milk production to favorably compete with beef, soybean and sugar cane production in Brazil?
- Under what conditions will dairy farming increase in the cerrado and Amazon regions of Brazil?
- How will the informal sector of Brazil’s dairy sector evolve? Will regulatory pressures and/or

economic incentives lead to a larger proportion of milk being sold to commercial processors?

- What are likely trends in consumer demand for Brazil’s dairy products? How do anticipated overall increases in dairy product consumption compare with anticipated increases in milk production? Are any particular dairy products likely to witness big increases in consumption?
- How have government policies impacted Brazil’s dairy sector and how are policies expected to change?
- Dairy processor concentration has increased in Brazil in recent decades. How will this development affect Brazil’s dairy exports?
- What are the objectives or strategies of the large foreign dairy firms (e.g., Nestle, Fonterra,

Parmalat, etc.) that have invested in Brazil’s dairy sector in recent decades? To satisfy domestic demand? To obtain dairy products for export?

- Which Brazilian dairy firms are most competitive in export markets?

The remainder of this paper is organized as follows: First, we describe Brazil’s geography and macroeconomic environment, emphasizing the importance of agriculture. Next, we describe and evaluate Brazil’s dairy farming and dairy processing sectors. We then review agricultural and trade policy developments affecting Brazil’s dairy industry. Finally, we summarize our assessment of Brazil’s future as a dairy exporter, and related implications for the U.S. and global dairy sectors.

II. GEOGRAPHY, ECONOMY AND THE ROLE OF AGRICULTURE

The distinctive characteristics of Brazil’s geography and growing economy will shape the future of many of the country’s industries, including the dairy industry. Therefore, it is useful to review information on Brazil’s geography and macro-economy to provide background for later parts of this report. We also describe Brazil’s agricultural sector, focusing on the country’s substantial role in world agricultural trade.

Brazil’s Geography

Occupying 8.5 million square kilometers, Brazil is the largest country in South America. The country’s large size relative to three neighboring trading-partner countries in South America is shown in Table 1. Brazil is about seven-eighths as large as the U.S.

In addition to the countries listed in Table 1, Brazil borders Bolivia, Colombia, French Guiana, Guyana, Peru, Suriname, and Venezuela (Figure 1).

Brazil has 26 states and one federal district. Brasilia, the country’s capital, is located in the Federal District. The country’s terrain consists mainly of flatlands and rolling lowlands in the North. Much of the remainder of Brazil is of varied topography and consists of plains, hills, mountains and a narrow coastal belt. Brazil’s climate is mostly tropical but temperate in the South.

Brazil has a high level of urbanization—8 of 10 Brazilians live in cities [60]. The 10 largest cities in Brazil, location of the cities by state, and city populations appear in Table 2. The population density in the country is highest in the south and on the Atlantic Seaboard where many of the 10 largest cities are located, and lowest in the west-central of the country. In the mid-2000s, Brazil had 100 cities with populations exceeding 250,000.

Brazil’s Economy

Brazil’s economy has improved substantially from the situation that existed two decades ago. But during the early and mid-2000s, Brazil was still a low per-

TABLE 1. Geographic Area of Brazil, Argentina, Uruguay, and Paraguay

Country	Geographic Area (Sq. Km)	% of U.S. Area
Brazil	8,511,965	86.62
Argentina	2,766,890	28.16
Uruguay	176,220	1.79
Paraguay	406,750	4.14

Source: [8].

FIGURE 1. Brazil's and Bordering Countries



former compared to other members of the rapidly-developing group of countries commonly referred to as the BRIC (Brazil, Russia, India and China). For example, Brazil's real Gross Domestic Product (GDP) growth rate from 2001 to 2006 was lower than that of Russia and only a fraction of the 6 to 10 percent GDP growth recorded in China and India during much of this period. Indeed, Brazil's real GDP grew more

TABLE 2. The 10 Largest Cities in Brazil

Rank	City	State	Population, 2006
1	São Paulo	São Paulo	11,016,703
2	Rio de Janeiro	Rio de Janeiro	6,136,652
3	Salvador	Bahia	2,892,625
4	Belo Horizonte	Minas Gerais	2,424,295
5	Fortaleza	Ceara	2,416,920
6	Brasilia	Federal District	2,383,784
7	Curitiba	Parana	1,788,559
8	Manaus	Amazonas	1,644,690
9	Recife	Pernambuco	1,515,052
10	Porto Alegre	Rio Grande do Sul	1,440,939

Source: [60]. Population figures do not include estimates for the entire metropolitan areas associated with the cities listed.

slowly during 2001 to 2006 than many of its neighbors in South America. Brazil's poorer economic performance in this period can be traced partly to low economic growth in certain geographical areas. For example, the economy of Rio de Janeiro, Brazil's second largest city, exhibited a zero growth rate from 1975 to 2006. According to the *Economist*, growth enterprises there are thwarted by bureaucracy and high taxes [15, p. 30].

The positives for Brazil's economy include an end to the hyperinflation of the early 1990s, higher growth of real GDP in 2007, a commodity-driven current account surplus for 2007, a budget surplus for 2007, and lower real interest rates that have sparked an upsurge in investment. Interestingly, Brazil's real interest rates in 2008 are forecast to be in the 7 to 8 percent range, which would be high enough to tip many economies into recession but are low by Brazilian standards [13].

Two pieces of good news emerged for Brazil's economy in 2008. First, Standard & Poor's raised the country's longer-term sovereign credit rating from BB+ to BBB- (investment grade) in April 2008, an important acknowledgement of economic progress made in the country [44]. Fitch Ratings gave an identical upgrade to Brazil's credit rating in May 2008, citing Brazil's success in taming once-rampant inflation as part of the reason for the upgrade [1]. Among other things, the upgrades will lower Brazil's borrowing costs in international credit markets.

Second, Petrobras, Brazil's state-controlled oil company, announced in April 2008 that it discovered a new oil deposit about 155 miles off the coast of São Paulo state [50]. The new field is close to Petrobras' massive Tupi field and may represent a large untapped resource for Brazil. However, the amount of oil in the new field has not yet been determined.

Statistics describing Brazil's economic situation appear in Table 3, together with figures for Argentina and the U.S. As noted later, the different economic situation facing Brazil relative to Argentina and the U.S. has implications for the country's milk production, dairy product consumption, and dairy exporting.

Most of the statistics in Table 3 are self-explanatory. Item 3 (2005 figure on percent of population below the poverty line) probably overstates the degree of poverty. A different estimate suggests that the percentage of Brazil's population with incomes below the poverty line may be as small as 23 percent [15, p. 30].

TABLE 3. Selected Statistics for Brazil, Argentina, and the United States

Item	Brazil	Argentina	U.S
1. Population (July 2008)	191,908,598	40,677,348	303,824,646
2. Population Growth Rate (%)	0.98	0.92	0.88
3. Population Below Poverty Line (%)	31	23.4	12
4. GDP (PPP in US\$, Trillion)	1.838	0.524	13.86
5. GDP Per Capita (PPP in US\$)	9,700	13,000	46,000
6. Real GDP Growth Rate (%)	4.5	8.5	2.2
7. Fixed Investment (% of GDP)	17.9	22.0	15.6
8. Unemployment Rate (%)	9.8	8.9	4.6
9. Inflation Rate (%)	4.1	8.5	2.7
10. Literacy Rate (%)	88.6	97.2	99.0
11. Corruption Perceptions Index	3.5	2.9	7.2

*Sources: CIA World Factbook [8] for items 1–10. Item 11 was obtained from Transparency International [56]. Items 1–2 represent 2008 figures. Items 4–9 and 11 represent 2007 figures. Item 3 represents 2005, 2007, and 2004 figures for Brazil, Argentina, and the U.S., respectively. Item 10 represents figures for 2004, 2001 and 2003 for Brazil, Argentina, and the U.S., respectively. For Item 9, the CIA World Factbook reports that the 8.5 percent inflation rate for Argentina is the official rate, but that the actual rate may be double the official rate. Key for interpreting Corruption Perceptions Index: 10 = highly clean, 1 = highly corrupt.

Brazil’s real GDP totaled \$1.838 trillion in 2007 measured in Purchasing Power Parity (PPP) terms, 3.5 times that of Argentina but only about one-eighth as large as that of the U.S. The per capita GDP figures expressed in PPP terms—which take into account differences in the cost of living among countries—show that Brazil’s citizens have incomes about 75 percent as large as those for Argentina but only 21 percent as large as those for U.S. citizens.

The implications of these income proxy figures for dairy product consumption patterns in Brazil must be interpreted cautiously. The low average incomes of Brazilians suggest that they would consume large quantities of dairy products with low-income elasticities of demand, for example, milk powder. However, there are many higher income consumers with substantial purchasing power who presumably would consume dairy products with high-income elasticities of demand, such as specialty cheeses and fluid milk products. Specifically, in 2004 the top 10 percent of Brazilian households had about 45 percent of the income and the bottom 10 percent had less than 1 percent of income [8]. These income distribution figures suggest that there may be sizable markets in Brazil for dairy

products with both low- and high-income elasticities of demand.

However, Brazil’s consumer preference patterns make it difficult to draw unambiguous implications about dairy product demand. Brazilians consume dairy products mostly for breakfast and their other meals tend to be meat-based. In addition, dairy desserts are not big consumption items in Brazil. Thus, drawing conclusions about future consumption of dairy products in Brazil based on expected income growth and population growth is more difficult than for many other countries.

Brazil’s unemployment rate in 2007 was slightly higher than that of Argentina and approximately double that of the U.S. The country’s literacy rate—while not abnormally low at 88.6 percent—masks problems with the country’s educational system. Many accounts suggest that Brazil’s educational system needs to be upgraded if the country is to sustain competitive rates of economic growth.

While corruption in Brazil is less prevalent than in earlier decades, it is still high by U.S. standards. Corruption—which tends to be correlated strongly with levels of regulation and bureaucracy in many countries—probably is a significant impediment to strong

economic growth in Brazil. High levels of regulation and bureaucracy are particularly discouraging to business entrepreneurship in Brazil. The International Finance Corporation's "Doing Business" study is instructive on this point, as noted below [14, p. 45]:

Starting a business (in Brazil) takes 152 days and requires 18 different procedures . . . It takes 2,600 hours for a medium-size business to keep up with its taxes each year. The same hypothetical business would pay 69% of its second-year profits in tax, if it played by the rules and did not receive special tax breaks.

Given this environment for entrepreneurship, it not surprising that Brazil's entrepreneurs show a willingness to bend the law [14, p. 45]. This presumably makes many Brazilian entrepreneurs both victims of, and contributors to, corrupt practices.

An employee of a major international dairy equipment company (interviewed by the study team in Brazil) claimed that corruption has become less of a problem in Brazil, noting that, "There are people who can help businesses work around the problem of corruption."

McKinsey analysts provide additional insights about Brazil's economy, particularly those relating to labor productivity in agriculture, as follows [28, p. 3].

. . . Inadequate regulation and the informal economy will continue to sap productivity in Brazil. . . . by allowing subscale enterprises to compete alongside efficient ones. Despite the presence of large, well-managed Brazilian players that control big shares of output and trade, the country's agricultural labor productivity, for instance, is only 5 percent of that in the United States. The size of the labor productivity gap is directly related to the large number of agricultural concerns dedicated to subsistence activities, often characterized by low capital utilization, suboptimal scale, and dismal efficiency levels.

Brazil's Exchange Rate

Changes in the value of the Brazilian currency deserve special attention in discussing Brazilian economic conditions and, especially, in evaluating export potential.

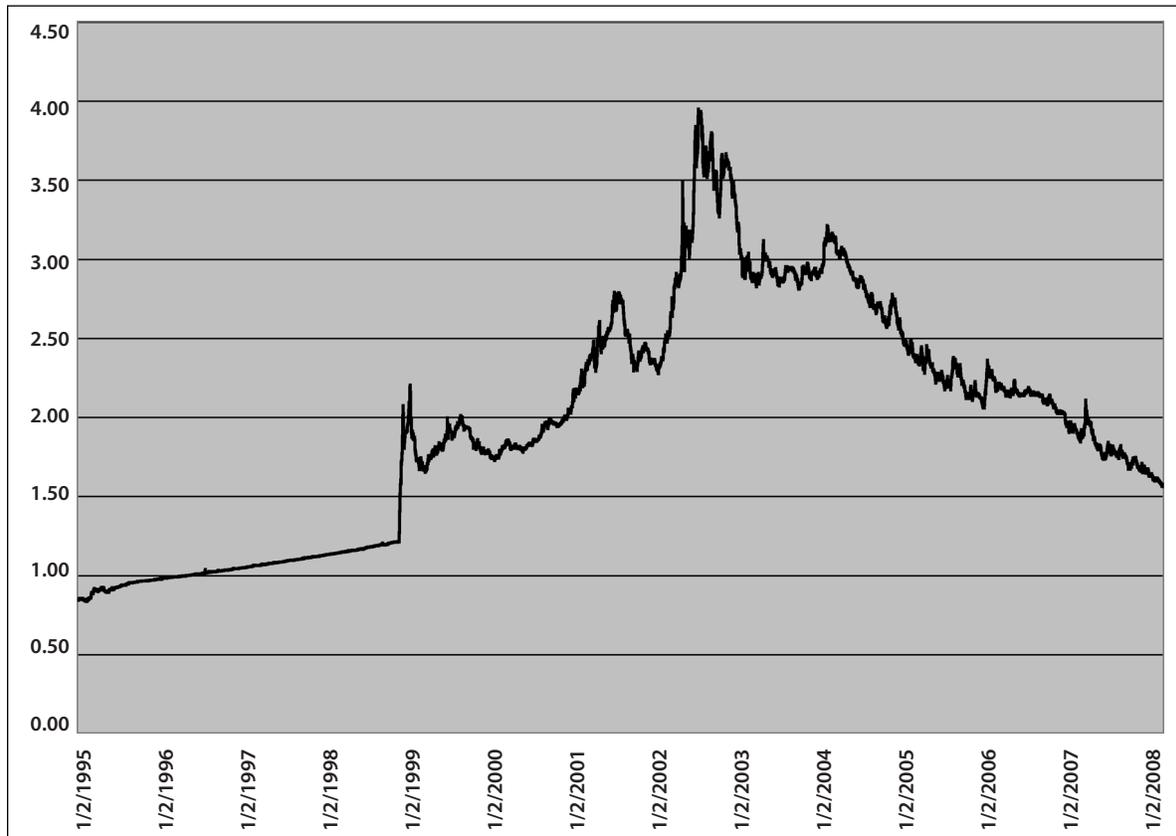
Brazil has faced exchange rate problems in the past decade. In the late 1990s, foreign investors feared that the Brazilian real was overvalued. At the dollar-pegged exchange rate employed in Brazil in the late 1990s capital outflows accelerated, rapidly depleting government hard currency reserves and creating fears of a financial crisis much like the one that occurred in Russia in 1998 [34]. As a result of these developments, Brazil's government on January 1, 1999 abandoned its dollar-peg and allowed the real to float.

After the dollar peg was eliminated, the real was weak and volatile during much of the time for about the next four years, reaching a low point of 3.93 reals to the U.S. dollar in late October 2002 (Figure 2). The real showed temporary strength after the U.S. recession in the early 2000s. But, beginning in 2003, the real began to exhibit generally consistent strength. For the first four months of 2008, the real averaged about 1.72 to the U.S. dollar. Thus, the Brazilian real went from being worth about US\$0.25 at its low point in October 2002 to US\$0.58 during the first four months of 2008, more than a two-fold increase.

The strength of the real reflects improvements in Brazil's macroeconomic policies in the mid-2000s. These policies helped to increase Brazil's exports, created a current account surplus, and gave Brazil large foreign currency reserves. Brazil's improved economic situation increased the demand for real-denominated assets and the strength of Brazil's currency in foreign exchange markets.

Will the real continue to be strong for the foreseeable future? Exchange rates are, of course, difficult to predict. Thus, it is difficult to predict whether the modest increases in the value of the U.S. dollar relative to the real in the autumn of 2008 foretells a more substantial weakening of the real. However, developments in place are likely to keep the real relatively strong. First, Brazilian real interest rates will remain high. In May, 2008 Brazil's benchmark interest rate (similar to the U.S. federal funds rate) was 11.75 percent and a number of analysts forecasted that the benchmark rate would be raised to 13 to 14 percent by year end, partly to curtail inflation. If Brazil's benchmark interest rates increase as forecast, Brazil's interest rates for 2008 will be 7 to 8 percentage points higher than inflation for the year. The 7 to 8 percent real interest rates are sharply higher than the very low or negative

FIGURE 2. Exchange Rate: Brazilian Reals per U.S. Dollar



Source: [30].

real interest rates that will be realized on certain U.S. investments in 2008 if the federal funds rate remains at about 1 percent.

Brazil faces the challenge of remaining competitive in export markets if the Brazilian real remains strong relative to the U.S. dollar. Brazil's government apparently would like to see a somewhat weaker real in order to enhance the competitiveness of the country's exports, but there is little that Brazil's central bank can do to slow the appreciation of the real against the U.S. dollar. The futility of trying was revealed when Brazil's central bank lost billions of dollars in 2007 in unsuccessful efforts via currency market transactions to slow the appreciation of the real against the U.S. dollar [2]. Concerted action from a number of central banks probably would be required to substantially strengthen the U.S. dollar relative to other currencies, including the real.

The robust economic conditions in Brazil that have accompanied the stronger real will likely foster expanded domestic consumption of dairy products

and, other things constant, tend to reduce exportable dairy surpluses. In addition, the strength of the real will almost certainly work to curtail the country's dairy exports to some extent relative to U.S. dairy products in foreign markets.

But recent developments tell a more nuanced story. Despite the growing strength of the real versus the U.S. dollar, Brazilian dairy exports rose to a record US\$300 million in 2007 (see Section IV). High international prices for dairy products meant exports were profitable enough to allow Brazilian dairy exporters to bid dairy products away from firms selling in the domestic market.

Land Resources

McKinsey analysts describe Brazil's farmland resources as a major positive factor that will enhance farming and agribusiness development in the country, as follows [28, p. 1]:

... favorable weather and soil create an ideal environment for crops and livestock. Brazil's endowment of arable land, for example, is a whopping 4,100,000 square Kilometers—roughly the size of the European Union before the addition of Bulgaria and Romania—only 17 percent of it now in use. Indeed, Brazil could more than double its current utilization level without harming the country's Amazon rainforest. China, India, and the United States all have less farmland and much higher utilization rates.

While this description of Brazil's arable land seems largely accurate, it may understate the possible damage from agricultural development to Brazil's Amazon rainforest. International and domestic concerns have been raised about how deforestation in the Amazon Basin is destroying habitat and endangering plant and animal species indigenous to the area [8].

The cerrado (Portuguese for "closed" or "inaccessible") is a vast tropical savanna eco-region of Brazil, which has undergone agricultural development in recent decades [59]. It consists of 1,916,900 square kilometers of territory—an area roughly the size of Alaska. It covers the Brazilian states of Goias, the Federal District, most of Mato Grasso, Mato Grosso do Sul, and Tocantins, the western portions of Minas Gerais and Bahia, the southern portions of Maranhao and Piaui, and small parts of three additional states.

Once thought to be of limited value for agriculture, the cerrado's productivity was increased by researchers at Embrapa (Brazil's Agricultural Research Corporation), who discovered that the fertility of cerrado soils could be substantially enhanced by appropriate additions of phosphorus and lime. Embrapa researchers also developed tropical (lower latitude) soybean varieties that were productive in the region.

Presently, the cerrado accounts for about 70 percent of the beef cattle production in the country and, thanks to irrigation and soil fertility enhancement techniques, it has become an important production center for soybeans, corn, and rice. But agricultural development in the cerrado involves numerous challenges. The Economist's Special Report on Brazilian Agriculture describes those challenges as follows [16, p. 75]:

Agriculture's march to the cerrado has been a march away from consumers. Despite the larger

scale of farmers in the center-west, their break-even point is 12% higher than that of southern farms . . . due largely to higher transportation costs.

Goldsmith and Hirsch report similar findings in a 2006 study, which showed that domestic freight costs for marketing soybeans produced in Central Brazil were \$0.51 (73 percent) per bushel higher than in southern Brazil. However, total production costs for soybeans in central Brazil were only about 9 percent higher than in southern Brazil.

The *Economist's* Special Report on Agriculture attributes Brazil's higher agricultural transportation costs in the cerrado and elsewhere in the country partly to a shaky infrastructure [16, p. 75]:

Just 10% of the country's roads are paved compared with 29% in neighboring Argentina...Brazil has neglected its railways, a more sensible way than roads to transport grain. Its navigable rivers do not traverse the heart of the country like America's Mississippi but veer off into the Amazon rainforest.

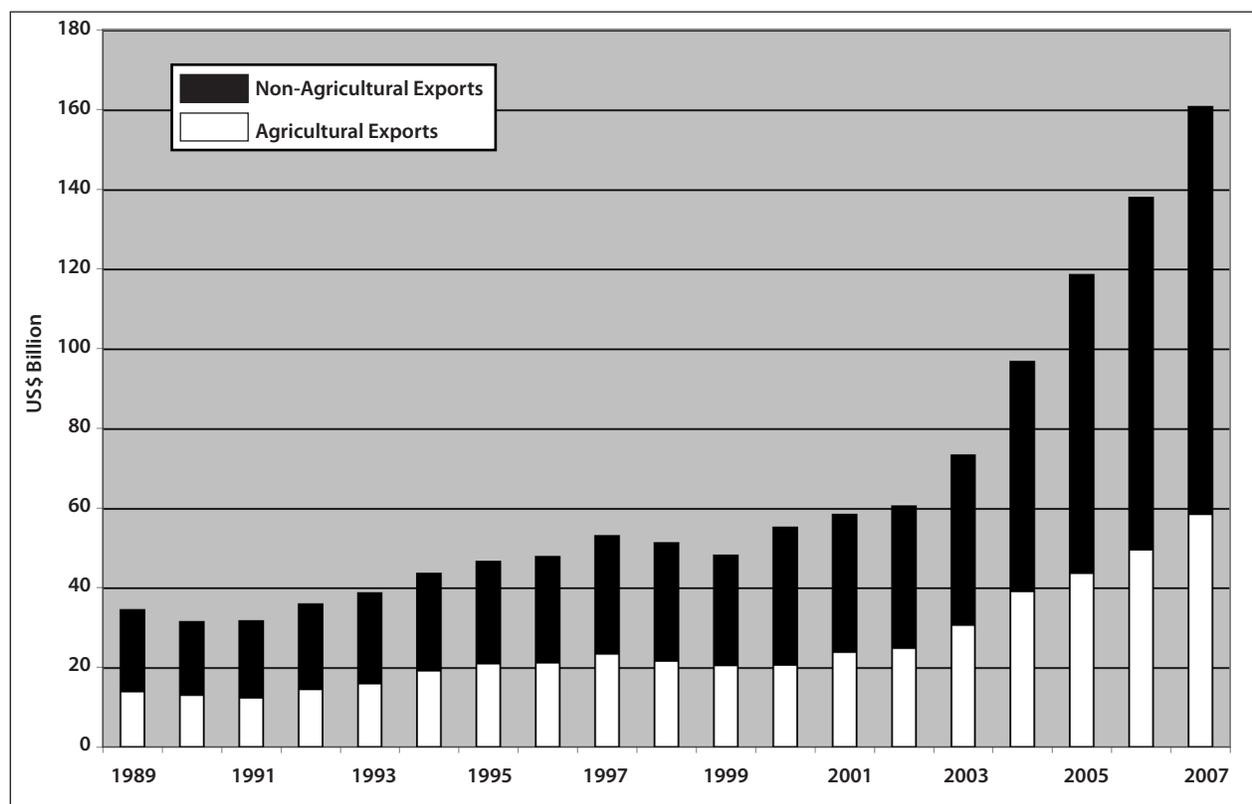
It is unclear how important the cerrado has become for dairy cattle production in Brazil. But clearly the grains and soybeans now produced in the cerrado could be important inputs for dairy cattle farming systems that use feed grains and soybeans as ration supplements.

Role of Agriculture in the Brazilian Economy

Agriculture is an enormous contributor to the Brazilian economy, both in terms of domestic economic activity and export earnings. In 2007, livestock and crop production accounted for 3.2 and 5.1 percent, respectively, of Brazil's GDP (Table 4).

The entire agribusiness complex has consistently contributed about a quarter of Brazil's GDP. Real total GDP grew by 20 percent between 1995 and 2007, while the real value of crop and livestock production grew by about 30 percent. This is evidence of historically high commodity prices in recent years. Despite Brazil's focus on bulk agricultural exports, the contribution of the agricultural processing and distribution sectors to GDP substantially outweighs that of the production sector.

FIGURE 3. Brazilian Exports



Source: [43].

tobacco (16 percent). Brazil was a close second to the U.S. in soybean exports, accounting for more than one-third of total world export value. Brazil was among the top ten exporters of cotton, pork and corn.

Agricultural exports have recently represented between 35 and 40 percent of total Brazilian exports (Figure 3). In real terms, the value of agricultural exports nearly tripled between 1999 and 2007. More important, Brazilian exports of agricultural products are several times imports, offsetting what is often a trade deficit for non-agricultural products (Figure 4).

The composition of agricultural exports in 2007 is shown in Figure 5. Soybeans, soybean products (soybean meal and soybean oil) and meats accounted for 39 percent of export value. Wood and forest products, sugar products (including sugarcane alcohol) and cof-

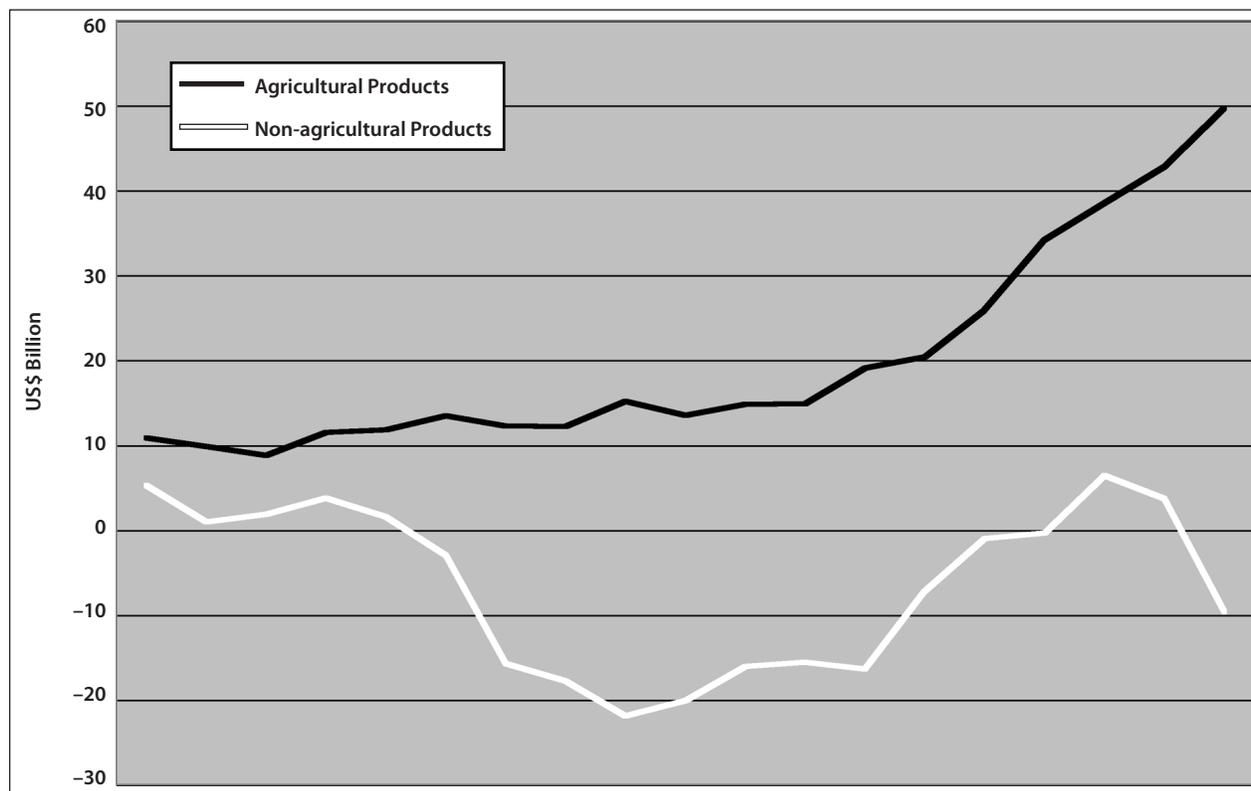
fee added another 33 percent. While totaling US\$300 million in 2007, exports of dairy products accounted for only 0.5 percent of Brazil's US\$54.8 billion in agricultural exports. For comparison, total U.S. agricultural exports in calendar year 2007 were US\$90 billion and dairy exports were about US\$3 billion.

Brazilian agricultural products were sold in 219 countries in 2007 (Figure 6). Since at least 1997, the United States has been the top overseas recipient of Brazilian agricultural goods.² The major products imported by the United States from Brazil are coffee (US\$700 million in 2007), frozen concentrated orange juice (US\$380 million), beef (US\$330 million), tobacco (US\$285 million), sugar (US\$185 million), nuts and nut products³ (US\$170 million), and cocoa (US\$110 million).

²The U.S. will likely lose its top spot to China in 2008. Through July, Brazilian exports to China were valued at US\$5.5 billion compared to US\$3.6 billion in sales to the United States.

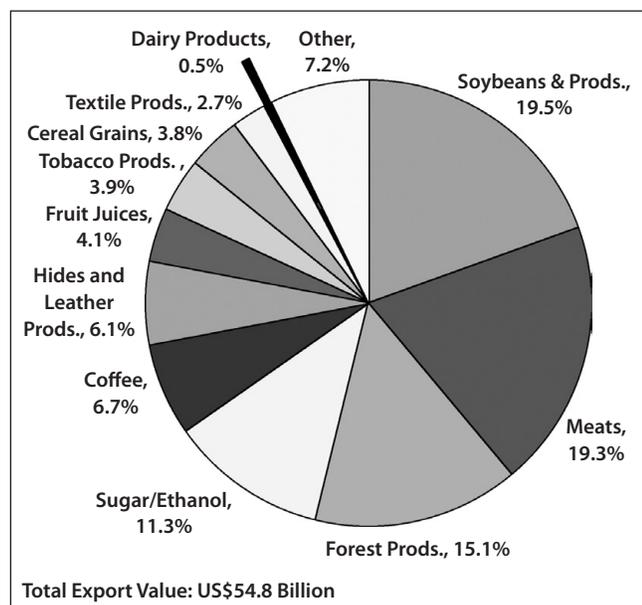
³It perhaps goes without saying that Brazil is also the largest world supplier of in-shell Brazil nuts, accounting for 72 percent of world exports in 2005.

FIGURE 4. Brazilian Trade Balances



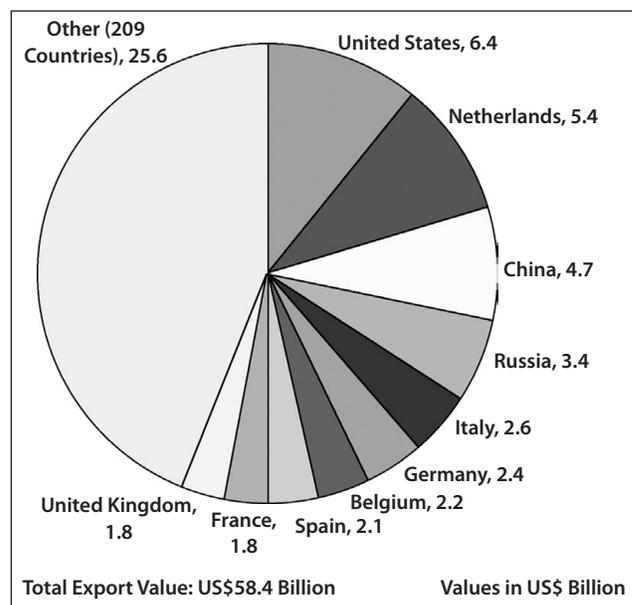
Source: [43].

FIGURE 5. Composition of Brazil Agricultural Exports, 2007



Source: [43].

FIGURE 6. Destination of Brazil Agricultural Exports, 2007



Source: [30].

Synopsis

Brazil is a potential agricultural powerhouse that is beginning to flex its muscles. Land resources have always been abundant and productive. What is different now is a much more favorable economic environment both internally and externally. In particular, strong world prices for most of Brazil’s export commodities have engendered confidence among existing

and new producers and encouraged expanded production. Possible constraints to growth are the high value of the Brazilian real, environmental concerns potentially leading to land use restrictions, and a poorly-developed infrastructure that elevates marketing costs above export competitors. A rapidly growing economy could also elevate wages to agricultural workers, increasing production and marketing costs.

III. DAIRY PRODUCTION SECTOR

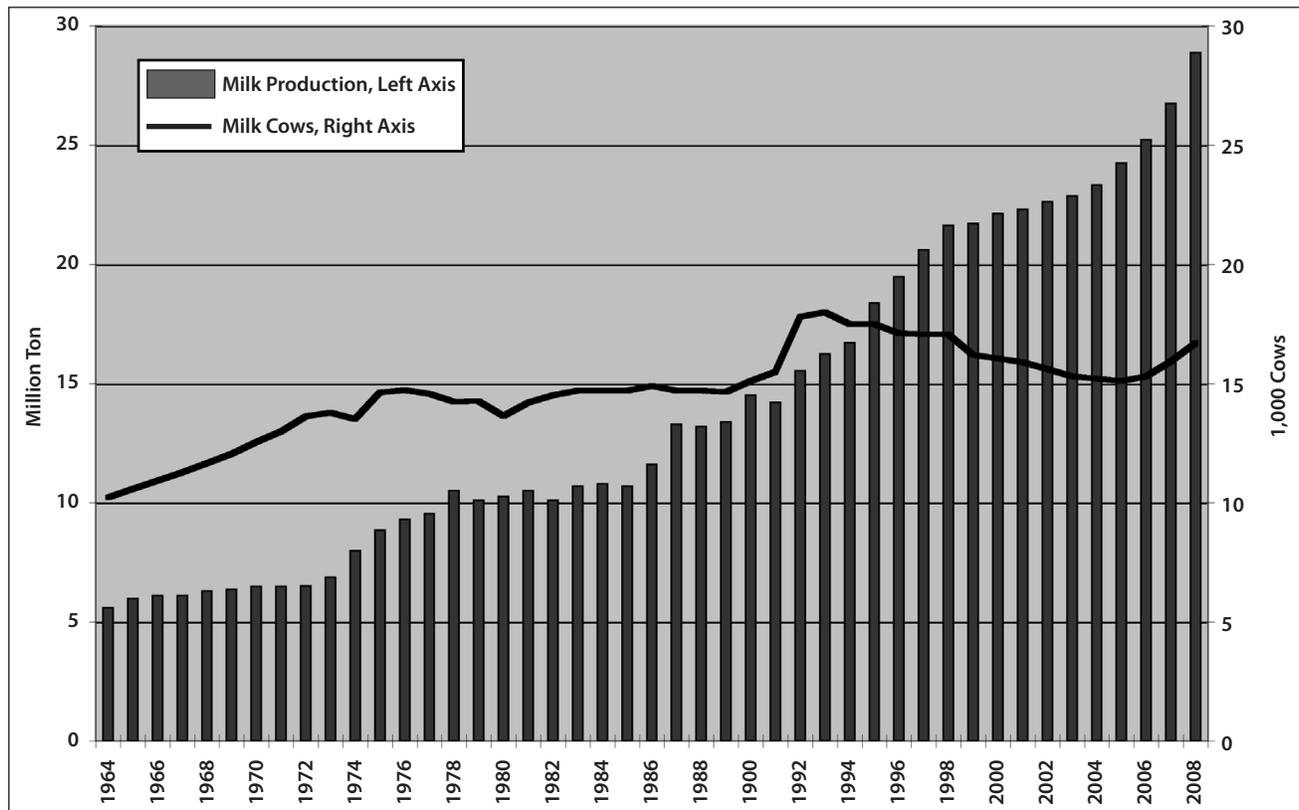
General Characteristics and Trends in Milk Production

Brazil produced about 27 million tons of cows’ milk in 2007 and, according to USDA’s Foreign Agricultural Service (FAS), is expected to produce 29 million tons in 2008 (Figure 7) [25].⁴ Production has about doubled

since 1990. The annual rate of growth has averaged 2.7 percent in this decade and has exceeded 4 percent since 2005.

After peaking at 18 million cows in 1993, Brazil’s dairy herd decreased to 15 million cows in 2005. FAS estimates 2008 Brazilian cow numbers at 16.7 million, an 11 percent increase in three years.

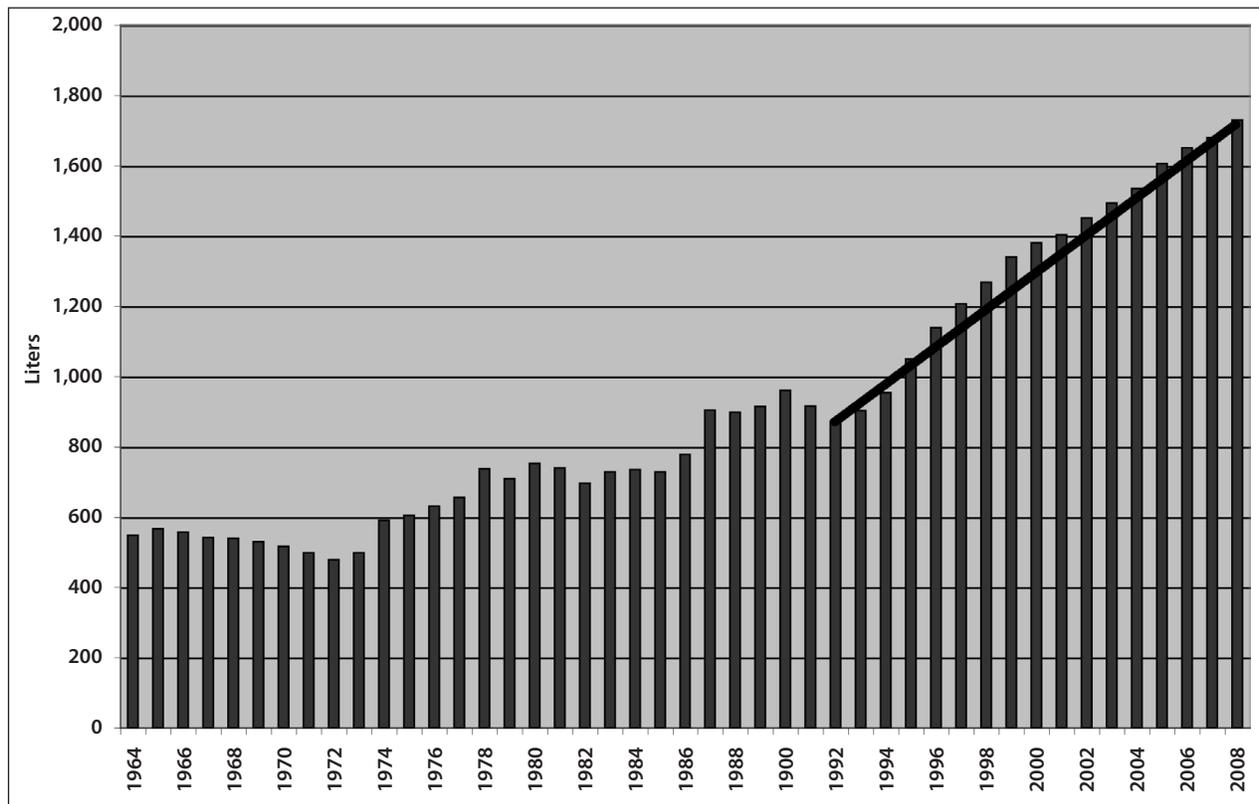
FIGURE 7. Brazil Dairy Cows and Milk Production



Source: [25]. 2007 Estimated and 2008 Forecast.

⁴ There are several, sometimes conflicting, sources of dairy production statistics for Brazil, including FAO, USDA- FAS, and the Brazilian government. We elected to use USDA statistics where there were differences, largely because changes in reporting definitions for official government statistics precluded comparing data before and after 1995. FAS data are adjusted to address this problem.

FIGURE 8. Brazil Milk Production per Cow



Source: [25].

Brazilian milk production grew even when cow numbers were falling because of impressive increases in milk yield per cow (Figure 8). The trend increase in yield since 1993 has been 4.3 percent, more than double the rate of growth experienced in the United States. However, this increase is from a very low base by U.S. standards. Current average annual milk per cow is about 1,700 liters (3,750 pounds), less than 20 percent of the U.S. average milk production.

Because most dairy farms use grazing as the primary source of feed, milk production in Brazil exhibits a seasonal pattern. Monthly production in the fall months of April, May and June, when cool, dry weather slows grass growth, is 20–25 percent less than during the warmer, wetter spring and summer months. While more seasonal than U.S. milk production, Brazil’s milk production is much more stable than in countries such as Ireland that rely even more heavily on rotational grazing and seasonal calving (Figure 9). Hence, seasonality does not appear to represent a significant problem for the processing sector or a constraint to expanding exports.

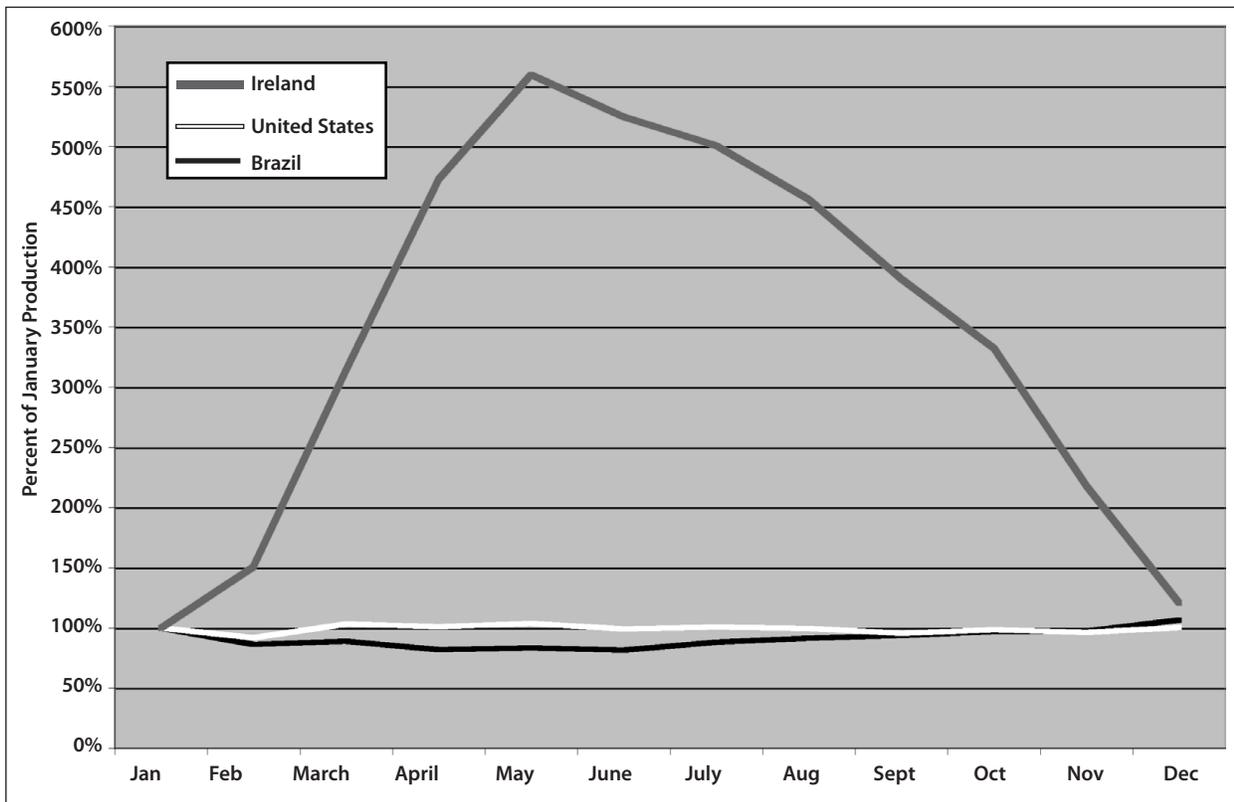
In 2006, Brazil produced about one-half of the total South American milk supply and accounted for about one-half of the South American population (Figure 10). Milk production on a per capita basis was 132 kg. This was exceeded by Argentina, Chile, Colombia, Ecuador and Uruguay. Uruguay led all South American countries in per capita milk production with 509 kg per person. For comparison, Wisconsin’s per capita milk production is about 1,800 kg.

Location of Production

Dairying in Brazil is geographically widespread, with all states reporting some milk production in 2007 (Table 6). However, production is concentrated in the area bounded by southern Goiás in the north to the Uruguay border in the south. Within this region, six states (Goiás, Minas Gerais, São Paulo, Paraná, Santa Catarina and Rio Grande do Sul) accounted for about three-quarters of Brazilian milk production in 2006.

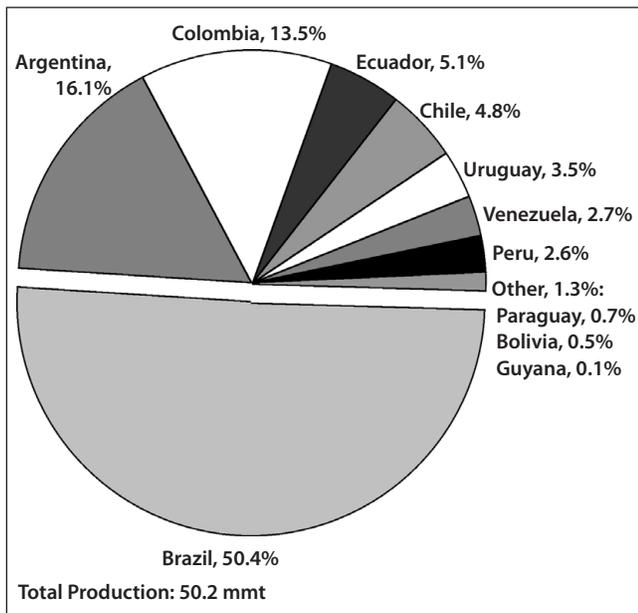
Between 1998 and 2006, the relative rate of growth in milk production was greatest in the Northern region,

FIGURE 9. Seasonality of Milk Production, 2007



Sources: Brazil [18, 19]; U.S. [45]; Ireland [5].

FIGURE 10. South American Milk Production, 2006



Source: [22].

but that area supplied less than 7 percent of Brazil’s 2006 milk supply and milk production there is used principally for local fluid milk consumption. The largest absolute growth was shown in Minas Gerais. Among major dairy states, São Paulo decreased milk production by 12 percent, the result of increasing competitive pressure for land to grow oranges, sugar cane and other crops.

Dairy Production Systems

Data relating to the number of dairy farms are only collected and reported as part of 10-year agricultural censuses, the latest in 1996.⁵ Projections of the 2005 dairy herd distribution using the 1996 census information are shown in Table 7 [19]:

Most of the 1.2 million farms in the smallest size category are diversified farms with dual-purpose, dairy-beef cows that are milked for relatively short

⁵The complete results of the 2006 census were not available at this writing.

TABLE 6. Change in Brazil Milk Production by State, 1998–2006

State/Region	Milk Production, 1,000 tons		1998–2006 Change	
	1998	2006	Tons	%
Brazil	18,694	25,398	6,704	36%
<i>North</i>	<i>903</i>	<i>1,699</i>	<i>796</i>	<i>88%</i>
Pará	311	691	380	122%
Rondônia	372	637	265	71%
Tocantins	140	217	77	55%
Acre	33	98	65	197%
Amazon	35	45	10	29%
Roraima	9	6	–3	–33%
Amapá	3	4	1	33%
<i>Northeast</i>	<i>2,070</i>	<i>3,198</i>	<i>1,128</i>	<i>54%</i>
Bahia	683	906	223	33%
Pernambuco	286	630	344	120%
Ceará	313	380	67	21%
Alagoas	245	228	–17	–7%
Maranhão	138	341	203	147%
Rio Grande du Nord	130	235	105	81%
Sergipe	118	243	125	106%
Paraíba	87	155	68	78%
Piauí	71	80	9	13%
<i>Southeast</i>	<i>8,465</i>	<i>9,740</i>	<i>1,275</i>	<i>15%</i>
Minas Gerais	5,688	7,094	1,406	25%
São Paulo	1,982	1,744	–238	–12%
Rio De Janeiro	455	468	13	3%
Espirito Santo	340	434	94	28%
<i>South</i>	<i>4,411</i>	<i>7,039</i>	<i>2,628</i>	<i>60%</i>
Rio Grande do Sul	1,915	2,625	710	37%
Paraná	1,625	2,704	1,079	66%
Santa Catarina	871	1,710	839	96%
<i>Central-west</i>	<i>2,845</i>	<i>3,722</i>	<i>877</i>	<i>31%</i>
Goiás	1,979	2,614	635	32%
Mato Grosso	406	584	178	44%
Mato Grosso do Sul	427	490	63	15%
Federal district	33	34	1	3%

Source: [19].



periods during the year. The number of lactating cows within this size category is less than half of total reported cows. On an annual basis, these smaller farms show herd productivity of only 385 kilograms (850 pounds) per cow. Typically, farmers in this size class milk indigenous cows, feed little or no concentrates or forages other than grass, breed cows using bulls kept on the farm, and use hand milking. Most of the milk produced on these small farms is either consumed on-farm or sold in the large informal market (see Section IV).

The remaining farms, most of which are specialized dairy farms, have an annual herd average of 2,300 kilograms (5,066 pounds) per cow. Among specialized dairies (including those in the smallest size category), there are at least four general production systems, all but one of which is pasture-based.⁶

Irrigated intensive rotational grazing. This system is not common presently, but is being promoted by a government-supported “Full Bucket” rural development program for small producers. The program promotes irrigated pasture management and stresses the importance of good herd management and accurate record-keeping. While pasture irrigation is not widely practiced in Brazil, it can result in significant increases

⁶The largest three of these dairy production systems are described in detail in Babcock Discussion Paper 2001-2 [54] and correspond closely to the three larger herd size categories defined in Table 7.

TABLE 7. Estimated Dairy Herd Size Distribution, Brazil, 2005

	Herd Size				Total or Average
	<30	30–70	70–200	>200	
Number of Farms					
Number	1,151,931	107,130	28,110	1,497	1,288,667
Percent of Total	89.4	8.3	2.2	0.1	100
Milk Production					
1,000 ton	4,598	9,061	9,023	1,889	24,572
Percent of Total	18.7	36.9	36.7	7.7	100
Number of Cows					
Number (1,000)	11,938	5,400	2,906	387	20,632
Percent of Total	57.8	26.2	14.1	1.9	100
Liters per Cow per Day	1.2	5	9	13	3
Average Cows per Farm	10	50	103	259	16

Source: [19].

in grass production, thus reducing the need for supplemental forages or feed concentrates.

Extensive grazing/limited supplementation. In this system, the dairy ration consists almost entirely of grazed pasture grass. Concentrates and green-chopped forages (principally sugar cane) would typically be provided only during those winter months when pasture growth was not sufficient to meet feed requirements. Herds employing this system would typically be in the 30–70 cow size range noted in Table 7, producing 1,200–2,000 liters per year. Herds would commonly consist mostly of cross-bred animals (dual-purpose dairy-beef animals and indigenous dairy breeds). Dry periods would be 8 to 10 months. Cows in these herds are usually hand-milked in parlors. Most of the milk from these farms is sold to processors but some would enter the informal market.

Semi-confinement. Farms employing this system are larger (70–200 cows) and use green-chopped forages (mostly sugar cane), stored silage, by-product feeds, and concentrates year-round to supplement grazed grass. Milk yield is in the range of 2,000 to 4,500 liters per cow per year. Cows are typically 50–50 cross bred Holstein x Gyr and artificial insemination is common. Milk produced on these farms (except

milk retained for farm use) is sold exclusively to processors.

Full confinement. This system is comparable to parlor-freestall dairy operations in Wisconsin. Typically, purebred Holsteins are fed conserved forages, by-product feeds, and concentrates in TMR form in freestall barns. Annual per cow milk yields are in excess of 4,500 liters, with some farms achieving twice that level.

Cost of Production

Embrapa Dairy Cattle provides four representative dairy farm models for the International Farm Comparison-Dairy project [36]. Two (25 and 50 cows) reflect conditions in Rio Grande do Sul and two (90 and 200 cows) represent the state of Minas Gerais. For 2006, full costs of production (including opportunity costs) for these farms ranged between US\$0.23 and US\$0.28 per 100 kg. Cash costs ranged from US\$0.18 and US\$0.25. In comparison, IFCN-generated full costs of production for U.S. farms ranged from US\$0.25 to US\$0.31; cash costs from US\$0.22 to US\$0.30.

More detailed cost information is available from a comparison of dairy farms by production system in the state of Rio Grande do Sul [54]. While these data

(Table 8) are specific to the state of Rio Grande do Sul, they appear to be applicable to farms in other states within the major producing region of Brazil that use similar production practices. Moreover, the production systems are comparable to the largest of the four systems defined by Embrapa, providing further insights into the relative costs and profitability by type of production system employed.

Perhaps the most remarkable aspect of milk production costs across systems is that total costs per liter are practically the same. However, the confinement system exhibits relatively high variable costs (reflecting higher

cost of feed) and relatively low fixed costs (reflecting higher milk yields and other economies to size).

Larger differences among the three production systems emerge when comparing elements of technical and economic efficiency (Table 9). The extensive and semi-confined herds have similar land area per cow, but the semi-confined herds show significantly larger milk production per hectare. Herds in the confined category have even larger production per hectare, but this measure is not directly comparable because land is used primarily for crop production rather than grazing.

TABLE 8. Dairy Costs and Returns by Production System

Item	Production System					
	Extensive		Semi-Confined		Confined	
	R\$/liter	%	R\$/liter	%	R\$/liter	%
Variable Costs						
Concentrates and minerals	0.161	32.0%	0.163	33.3%	0.192	38.0%
Other purchased feeds	0.069	13.7%	0.065	13.3%	0.087	17.2%
Milk hauling	0.072	14.3%	0.042	8.6%	0.040	7.9%
Vet and med	0.022	4.4%	0.029	5.9%	0.031	6.1%
Breeding	0.008	1.6%	0.011	2.2%	0.011	2.2%
Elec., fuels and lubricants	0.026	5.2%	0.025	5.1%	0.024	4.8%
Taxes	0.012	2.4%	0.017	3.5%	0.013	2.6%
Pasture rent	0.001	0.2%	0.003	0.6%	0.004	0.8%
Pasture maintenance	0.000	0.0%	0.002	0.4%	0.000	0.0%
Facility repair/improvements	0.003	0.6%	0.005	1.0%	0.005	1.0%
Equipment repair/maintenance	0.007	1.4%	0.017	3.5%	0.015	3.0%
Dairy supplies	0.004	0.8%	0.003	0.6%	0.003	0.6%
Other costs	0.002	0.4%	0.003	0.1%	0.004	0.8%
<i>Total Variable Costs</i>	<i>0.387</i>	<i>76.9%</i>	<i>0.383</i>	<i>78.2%</i>	<i>0.429</i>	<i>85.0%</i>
Fixed costs						
Adm. services and consulting	0.015	3.0%	0.027	5.5%	0.027	5.4%
Fees, taxes and interest	0.002	0.4%	0.005	1.0%	0.013	2.6%
Depreciation	0.039	7.8%	0.034	6.9%	0.012	2.4%
Labor costs	0.060	11.9%	0.041	8.4%	0.024	4.8%
<i>Total Fixed Costs</i>	<i>0.116</i>	<i>23.1%</i>	<i>0.107</i>	<i>21.8%</i>	<i>0.076</i>	<i>15.0%</i>
Total costs	0.503		0.490		0.505	
Total receipts	0.574		0.596		0.613	
Net income	0.071		0.106		0.108	

Source: [54]. Costs are for the period October 2004–September 2005 for farms in the vicinity of Castro, PR.

TABLE 9. Measures of Technical and Economic Performance by Production System

	Production System		
	Extensive	Semi-Conf.	Confined
Measures of Size			
Average herd size	36.50	110.31	423.91
Cows in lactation (average per day)	22	66	261
Farm size (hectares)	16.8	43.5	122.2
Value of assets, incl. land (R\$)	216,787	825,787	254,846
No. of hired employees (full-time equiv.)	1.1	2.0	8.9
Milk production (1,000 L/year)	123	556	2,705
Break-even production (1,000 L/year)	101	468	2,246
Measures of Performance			
Milk prod. per hectare (L/ha/year)	7,366	12,790	22,129
Milk prod. (L) per kg concentrate	2.72	2.71	2.79
Milk prod. per employee (L/day)	310	766	832
Return on assets (%)	9.7	13.3	15.3

Source: [54].

While concentrate feeding varies substantially across production systems, milk yield per unit of concentrate fed is nearly the same. Labor efficiency increases with herd size. Daily milk production per employee for the semi-confined system is more than double what is achieved for the extensive system. The confined system shows the highest return on assets, but all three models exhibit double-digit or near double-digit rates of return.

Comparing performance across systems leads to the conclusion that all systems are economically viable, even at the relatively low milk prices observed in 2005. But the greater efficiency and profitability of the semi-confined and confined systems suggests that growth in milk production is likely to come from herds utilizing these systems.

Milk Prices

From 1999 through 2004, milk prices in Brazil ranged between US\$10–\$15 per 100 kg (US\$4.50–\$7.00 per hundredweight). This was about half the price level experienced in Wisconsin (Figure 11). These relatively low prices limited incentives for dairy expansion. Brazil milk prices rose steadily to the low

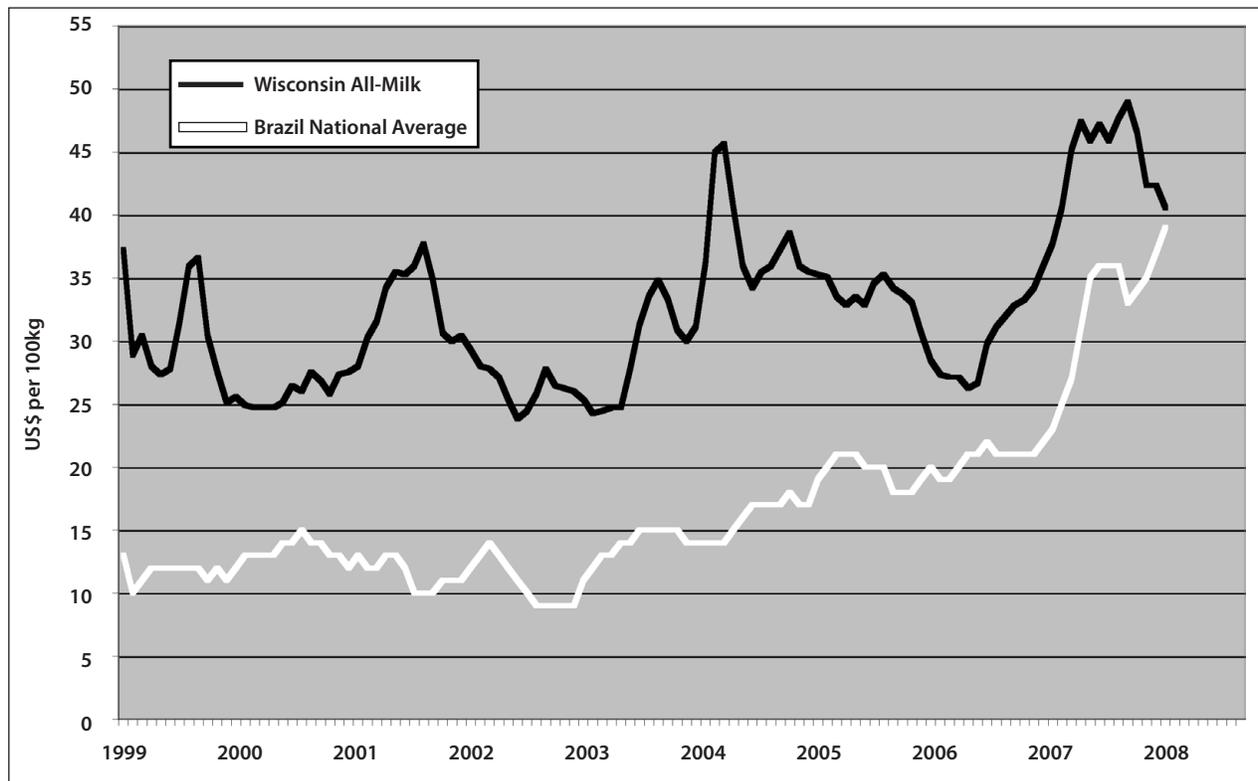
US\$20/100 kg mark by early 2007, which was only about US\$5 under the Wisconsin all-milk price. Since then, Brazil milk prices have nearly doubled and have come even closer to those experienced in Wisconsin, leading to strong profits and encouraging production growth.

The level and stability of farm milk prices will be a critical factor in the evolution of the Brazilian dairy sector. Stable milk prices at or near current levels will encourage expansion of farms employing higher-yielding production systems that require major capital investment. This will spur gains in milk production that will likely exceed those shown recently. If prices revert to levels experienced earlier in this decade, then growth will be slower, and will be confined largely to production systems that are part of diversified farming operations that require minimal investment per cow and that rely more heavily on grazing for feed.

Supporting Services

Brazil has a good supply of dairy service providers in the primary producing region. Veterinarians are in especially ample supply—many DVMs are employed in other segments of the dairy sector besides animal

FIGURE 11. Brazil and Wisconsin Average Milk Prices



Source: [6, 45].

health. Concentrates, by-product feeds and dairy supplies appear to be readily available. Of particular note, the large frozen concentrated orange juice industry of Brazil is located in close proximity to the major dairy region, making citrus pulp readily available to most dairy farms.

Dairy production (and processing) research at the federal level is primarily through Embrapa, the Brazilian Agricultural Research Corporation, under the Ministry of Agriculture, Livestock and Food Supply. Embrapa’s stated mission is to, “. . . provide feasible solutions for the sustainable development of Brazilian agribusiness through knowledge and technology generation and transfer” [18]. Embrapa operates 40 research and education centers located throughout Brazil.

The Embrapa Dairy Cattle center is located in Juiz de Fora, MG, with satellite field stations in Pacheco Colonel, MG, and Valença, RJ. Embrapa has an extensive research agenda covering major aspects of dairy farming and dairy processing. Much of this research is conducted collaboratively with state organizations, state and federal universities, and private dairy companies.

Embrapa’s educational/extension programs also cover a broad spectrum of topics relating to both dairy production and processing. Information is disseminated through publications, short courses and one-on-one consulting.

Besides Embrapa Dairy Cattle, state and federal universities, dairy plants, and dairy trade associations also offer extension support to Brazilian dairy farmers. Special extension programs for lower-income farmers are sponsored by the Agency for Agrarian Development and Agricultural Extension within the federal Agrarian Ministry for Public Works and the Economy (separate from the Ministry of Agriculture, Livestock and Food Supply).

Dairy farmers are represented legislatively by the Confederation of Agriculture and Livestock of Brazil (CNA). CNA’s executive body is a council of representatives of state agricultural federations. It is organized around 21 “theme groups” that involve commodities (including dairy) and special interest issues (e.g., credit, foreign trade) [9].

Synopsis

Brazilian milk production has grown more rapidly than domestic use since 2004, yielding an increasing exportable surplus. Growth has come from more cows and more milk per cow. While more than 1.2 million Brazilian farms produce milk, about 135,000 herds with more than 30 cows account for more than 80 per-

cent of Brazil's milk production and an even larger proportion of milk sold in the formal market. Recent growth in milk production has been spurred by strong milk prices that have encouraged investment in these larger dairies that employ higher-yield production strategies.

IV. DAIRY PROCESSING SECTOR

Overview

Brazil's dairy processors are part of a rapidly-evolving, multi-faceted industry. Fluid milk constitutes about one-third of total dairy products processed and marketed in Brazil. UHT milk represents 70 to 75 percent of fluid milk sold in the country. The informal market (mostly non-federally inspected milk) constitutes about 35 percent of the milk consumed in the country. Milk powders—a major export item for Brazil's dairy industry—represent a growing segment in the dairy processing business in Brazil. Processing concentration is increasing rapidly in the industry. Finally, new entrants into dairy processing from Brazil's meat processing business (e.g., Perdigão and Sadia) have contributed to the increased concentration and provide competition for existing processors.

Structure of Brazil's Dairy Processing Industry

Brazil's dairy processing sector is extensive, diverse and complex. It consists of a large informal sector and a formal sector with a few large private companies and federated cooperatives and a large number of local cooperatives.

Informal milk is product that is not sold to federally-inspected dairy plants. The estimated volume has been fairly constant over the past 10 years at 8 to 9 million tons [57]. Because milk production has increased rapidly, the percentage sold informally has decreased from more than 41 percent in 1998 to 32.5 percent in 2007. The ultimate use of informal milk is not officially recorded, but USDEC estimated that in 2006, about 6.5 million tons was used to manufacture various cheeses. Milk used to produce cheese in federally-inspected plants in 2006 was only 4.2 million tons.

TABLE 10. Selected Statistics for Largest Brazilian Dairy Processors, 2007

Rank	Company	Affiliated Producers		Average Daily Production (liters)
		Milk Receipts (1,000 liters)	Number	
1	DPA*	1,800,000	5,800	567
2	ELEGÊ	1,324,007	18,801	130
3	ITAMBÉ	1,090,000	9,067	284
4	Parmalat	725,021	4,457	286
5	Bom Gosto	632,735	9,690	138
6	Laticínios Morrinhos	387,140	4,500	225
7	Embaré	336,573	2,208	395
8	Confepar	333,490	7,393	90
9	Centroleite	300,095	5,265	156
10	Líder Alimentos	248,725	5,390	114
11	CCL	247,950	2,439	134
12	Batávia	246,459	4,215	160
13	Frimesa	225,804	4,847	123
14	Danone	222,091	418	865
15	Nilza Alimentos	219,449	872	131
16	Group Vigor	201,300	1,213	313
Total/Average		8,292,889	86,575	200

* DPA acquisitions of raw milk by Fonterra for processing by Nestle.

Note: Average daily production cannot be calculated by comparing number of producers and total milk receipts because most companies use spot market purchases to acquire varying amounts of their total milk supply.

Source: [19].

Brazil's 16 largest dairy processors, ranked in terms of milk receipts in 2007, are listed in Table 10. While this is a recent Brazilian dairy processor list, it fails to take into account some the mergers, acquisitions, and consolidations that have occurred in recent months. Certain firms in the list, which have been acquired by Perdigão (e.g., Batavia, Elegê and CCL Cooperative) and Sadia will be noted later in this section.

Leading processors include a mix of large federated cooperatives (e.g., Itambé, Confepar, Centroleite), private Brazilian companies (e.g., Embaré, Nilza Alimentos, Group Vigor), and widely-recognized multinational companies (e.g., Nestle, Parmalat, Danone). The combined milk receipts of the 16 top processors represented about one-half of the total receipts of federally-inspected plants. The other one-half was acquired by more than 1,100 smaller plants, 60 percent of which process less than 10,000 liters per day. Most of these smaller processors are local cooperatives that also provide feed and dairy supplies to their members. To remain viable, these small cooperatives are increasingly joining with others to collectively process or market their milk through contractual arrangements.

The leading processors show significant differences in the number and average size of producers from whom they draw their milk supply. The extremes are Condefar, which acquires milk from 7,400 producers averaging 90 liters per day, and Danone, with 418 regular suppliers averaging 865 liters per day.

Increases in dairy processing concentration have occurred in Brazil in recent years as milk processors have sought to countervail the growing power of domestic supermarkets, gain scale economies, and secure milk and dairy product marketing improvements that can be achieved via increased scale [23]. This trend will undoubtedly continue, reducing the size of the competitive fringe of processors and perhaps increasing the international competitiveness of Brazilian dairy processors.

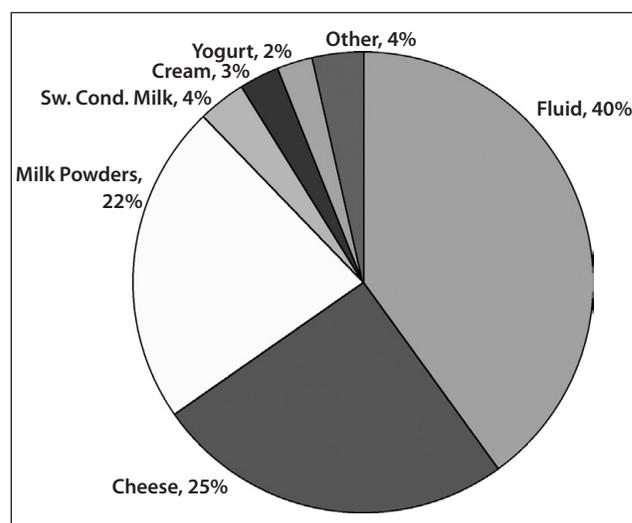
However, Brazil's dairy processing industry will not soon approach the concentration levels found in major dairy exporting countries, such as New Zealand, Denmark and the Netherlands. In the early 2000s, one processing firm accounted for 80 percent or more of the milk processed in both New Zealand and Denmark and two firms processed 80 percent or more of the milk in the Netherlands [12].

Product Mix

Figure 12 shows use of milk by the formal sector in 2006. Forty percent of the milk processed by inspected plants was sold as pasteurized or Ultra High Temperature (UHT) fluid milk. Cheese and milk powders (SMP and WMP) together absorbed about one-half of the formal sector milk supply. Milk powders and sweetened condensed milk (SCM) (4 percent of milk use) are produced largely for export.

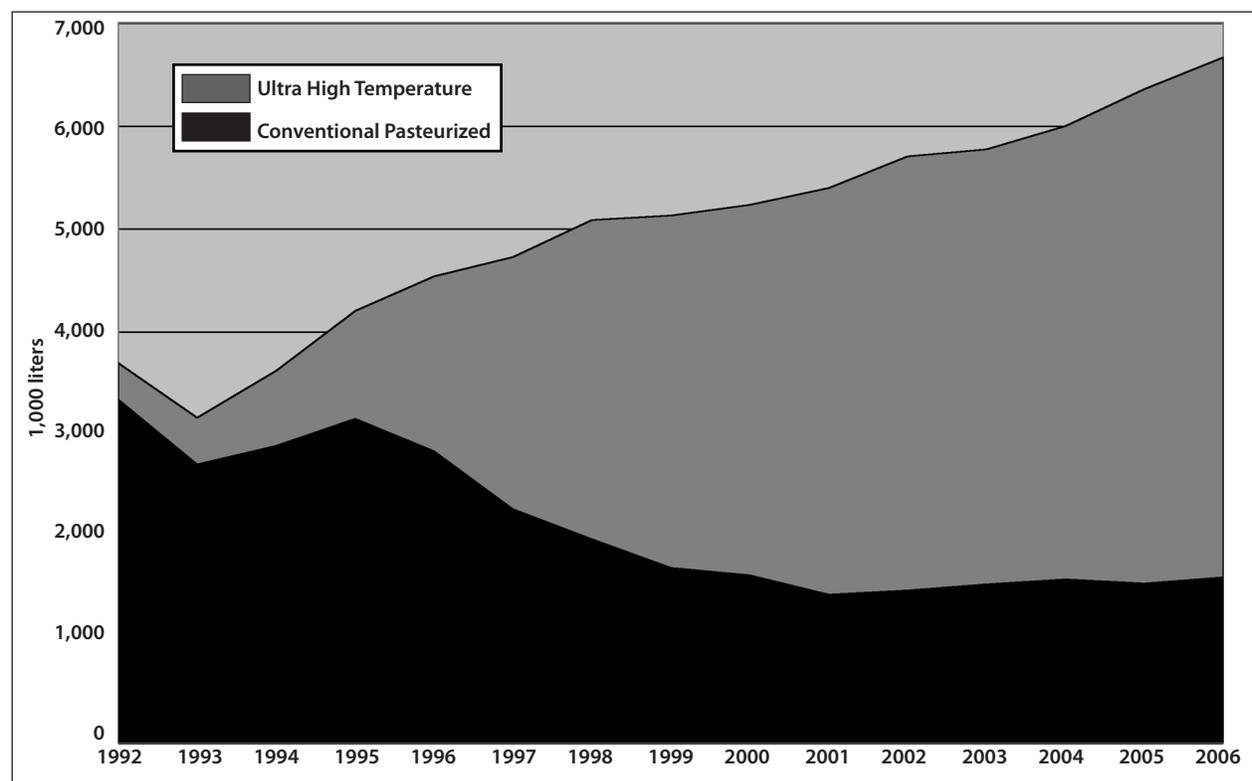
Use of Brazilian milk production for fluid milk grew from 3.7 million liters in 1992 to 6.6 million liters in 2006 (Figure 13). Nearly all of that growth was in the form of UHT, or long-life milk. The growth of UHT milk sales in Brazil provides additional background on developments in Brazil's dairy processing industry. The rapid increase in UHT milk processing and sales has made it possible for the industry to produce fluid milk for sale in cities distant from milk processing plants. One official interviewed by the study team argued that UHT milk has detrimentally eliminated the regional definition of dairy production in Brazil's dairy industry. The UHT milk processing segment also has been at the forefront of industry consolidation in recent years. Finally, UHT milk plants have been a vehicle by which new entrants have gained a foothold in Brazil's dairy processing industry. Perdigão, for example, entered dairy processing partly by purchasing UHT milk plants.

FIGURE 12. Utilization of Brazil Milk, Receipts by Federally Inspected Processors, 2006



Source: [57].

FIGURE 13. Brazil Fluid Milk Sales



Source: [19].

Brazil Dairy Exports

While numerous facets of Brazil's dairy industry are important, we are particularly interested in the capacity of Brazil's dairy processing industry to expand dairy exports.

Dairy exports represent less than 1 percent of Brazil's huge agricultural export value (see previous section), but have grown significantly in this decade (Table 11). In 2007, total dairy export value was \$300 million compared to \$8 million in 1999.⁷ In 2008, dairy exports through July were nearly equal to 2007's annual total.

Skim and whole milk powders (SMP and WMP) represented more than 60 percent of Brazil's 2007 dairy export value (Figure 14) and an even larger share of 2008 exports through July. Powder exports are about 75 percent WMP [27]. The growth in powder exports has been remarkable, from less than US\$1 million in 1999 to nearly US\$200 million so far in 2008 [43].

Exports of sweetened condensed milk (SCM), which once accounted for half of Brazil's dairy export value, have remained strong in absolute terms, but represented only one-sixth of 2007 dairy export value.⁸

Brazil has gone from a large importer of dairy products to a major net exporter. Its dairy trade balance measured in value went from a deficit of more than US\$500 million in 1998 to a surplus of about US\$150 million in 2007 (Figure 15). Clearly, much of the recent growth in Brazil's milk production has gone to import substitution.

Brazil's dairy exports are widely scattered geographically. In 2007, Venezuela, Algeria and Senegal accounted for about one-half of total export value [2, p. 93]. No other country took more than 3.1 percent. The U.S. was a minor export market, absorbing US\$6.5 million, 2.4 percent of Brazil's total dairy export value. U.S. dairy exports to Brazil in 2007 were valued at US\$16.5 million. Over the past 10 years,

⁷ Brazil dairy exports in 2007 were 10 percent of U.S. dairy exports.

⁸ Production of canned sweetened condensed milk takes advantage of two commodities in plentiful supply in Brazil: tin and sugar.

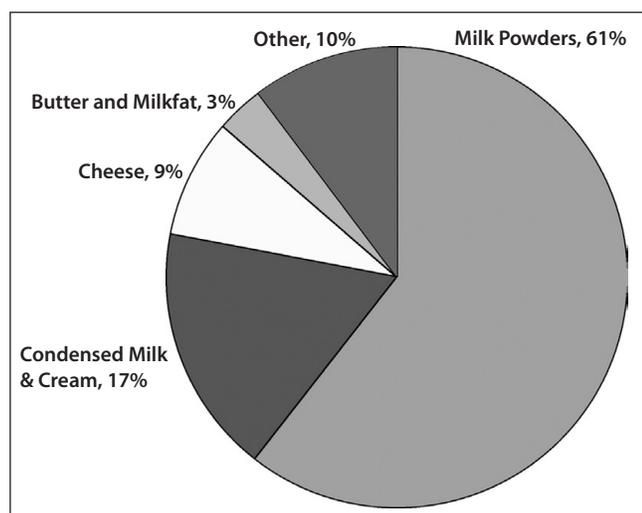
TABLE 11. Evolution of Brazil Dairy Exports, 1997–2008

Year	Value in US\$					Total
	Milk Powders	Condensed Milk & Cream	Cheese	Butter	Other	
1997	2,825,540	1,137,535	1,668,671	3,460,911	1,563,648	10,656,305
1998	2,681,404	1,316,583	3,431,704	172,213	980,659	8,582,563
1999	532,041	2,522,966	3,394,093	83,539	1,629,091	8,161,730
2000	595,648	4,422,849	7,014,191	162,547	3,383,561	15,578,79
2001	1,823,583	8,212,727	6,343,825	3,611,075	7,381,565	27,372,775
2002	6,310,816	22,639,964	4,973,307	446,998	7,755,194	42,126,279
2003	10,225,033	27,057,947	6,799,718	2,562,838	10,343,141	56,988,677
2004	47,664,180	29,403,343	14,576,078	1,848,151	20,102,041	113,593,793
2005	59,592,033	36,268,113	28,883,367	3,551,290	22,415,717	150,710,520
2006	44,155,471	69,245,445	20,936,145	2,834,101	31,538,847	168,710,009
2007	181,332,962	52,085,700	25,724,166	9,417,303	31,004,774	299,564,905
2008*	197,644,271	50,630,338	18,607,301	9,600,549	14,514,639	290,997,098

*Total, January–July.

Source: [43].

FIGURE 14. Composition of Brazil Dairy Exports, 2007



Source: [43].

dairy trade between Brazil and the U.S. has been small and, on average, balanced.

Geographical diversification in Brazil dairy exports should help to spread exporting risk over a number of countries. However, diversification also requires Brazilian dairy exporters to become familiar with customer requirements in a large number of countries.

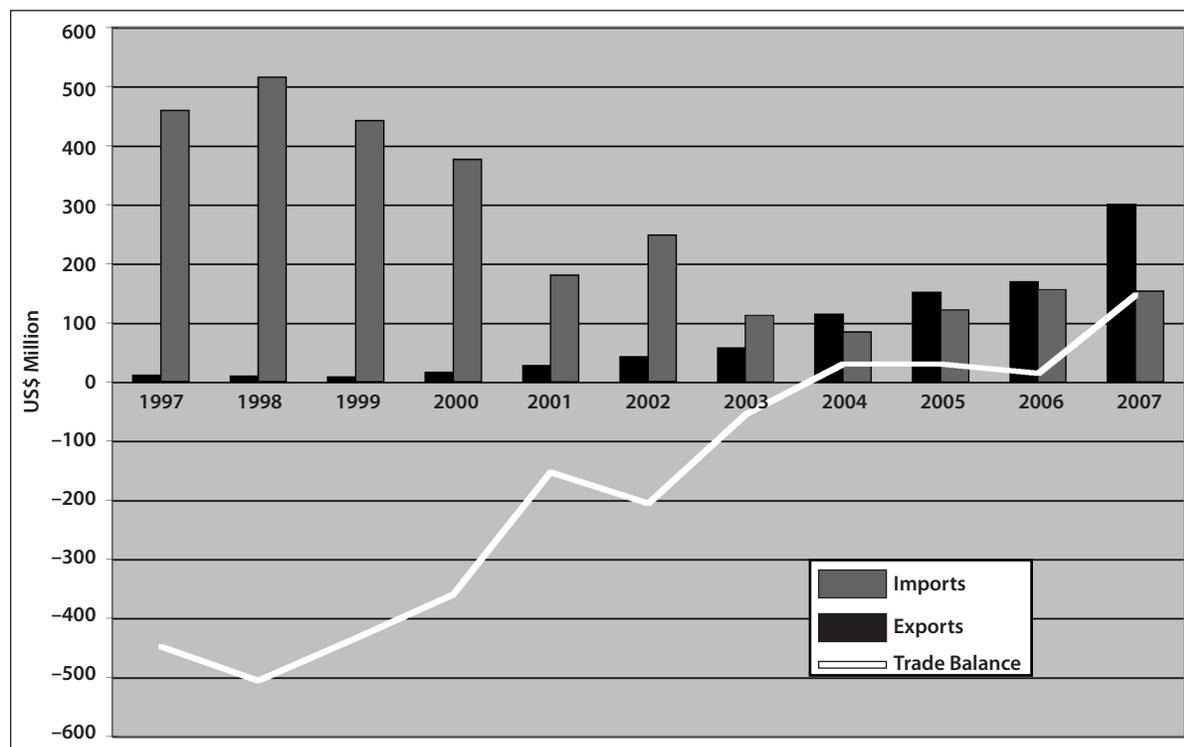
As noted earlier Brazil’s dairy industry consists of a relatively few big firms and a large competitive fringe.

On average Brazil’s dairy processing plants are small compared to processing plants in major dairy export countries, suggesting constrained ability to meet international competition.

An exception is milk condensers and dryers. About 15 percent of the country’s major milk powder and SCM processors have installed capacity of 1.0 to 1.5 million liters of milk per day and 10 percent have capacity of 600,000 to 800,000 liters of milk per day. Evidence suggests that a processing capacity of about 500,000 liters per day is necessary to be competitive [57, p. 65]. Thus, by this measure one-quarter of Brazil’s milk powder and SCM processors may have the scale of production that would help to make them competitive in international markets.

A somewhat different picture of Brazil’s dairy processing industry is presented by a listing of major foreign multinational firms operating in Brazil’s dairy industry (Table 12). While many of these firms serve mainly the Brazilian domestic market, these firms presumably could become involved in exporting Brazilian dairy products if prospective exporting profits warrant. However, with a few notable exceptions (such as Nestle and Fonterra) this listing suggests potential for expanded Brazilian dairy exports rather than tangible prospects for actual expansion of dairy exports.

FIGURE 15. U.S. Dairy Trade Balance—U.S. Dollars



Source: [30].

Major Dairy Exporting Firms

Dairy Partners of America (DPA) and SERLAC pioneered the exporting of dairy products from Brazil. DPA, which represents a joint venture between Nestle and Fonterra of New Zealand, was launched on January 1, 2003 [24, (11/17/03), p. 11]. Headquartered in Brazil, DPA began its operations in Brazil, Argentina and Venezuela, and expanded later to Chile, Ecuador, Colombia and the Caribbean Islands. Initially, Nestle’s seven milk plants in Brazil served as the production base for DPA.

USDEC reported that in 2006 and 2007 about 55 percent of total Brazilian dairy exports were manufactured by DPA and Nestle [57, p. 64]. The exports consisted mainly of bulk bags of milk powder and cans of SCM.

Nestle. Switzerland-based Nestle has had operations in Brazil for about a century, with plants located throughout the country. This dispersion of plants helps Nestle to spread price and weather-related risks geographically. In addition, by being positioned to sell dairy products in the state where the products are man-

ufactured, the company avoids taxes associated with interstate sales of dairy products.

Nestle is frequently mentioned as a price-leader in setting farm milk prices in Brazil. However, a number of processors interviewed by the study team disputed this claim, arguing that this may be the case only in areas where Nestle faced little competition in milk procurement.

Most dairy processors interviewed by the study team conceded that Nestle would be a top player in Brazil’s dairy industry for the foreseeable future. However, many of these same officials pointed out that Perdigão is challenging Nestle for the top spot in the industry.

Fonterra. This cooperative is the world’s largest dairy exporting firm with dairy sales in 140 countries. Fonterra’s expertise in dairy exporting and foreign direct investment in dairy-food businesses undoubtedly will help to expand Brazil’s dairy exports if profit prospects warrant such an expansion.

DPA announced plans in early 2008 to build a new milk processing plant in Palmeira das Missoes in the Rio Grande do Sul with a capacity to process about one million liters of milk per day [3]. The milk would

TABLE 12. Major Foreign Multinational Companies Operating in Brazil's Dairy Industry

Company/Headquarters	Type of Business	Dairy Products Manufactured or Handled
Cargill, U.S	Manufacturer	Dried whey and other
Danone, France	Manufacturer	Yogurts, chilled desserts, yogurt, whey drinks, fermented milk, cream cheese spread and other
Arla Foods, Denmark and Sweden	Manufacturer	White cheese, spreads
Nestle and Fonterra, Switzerland and New Zealand (DPA)	Manufacturer, exporter and importer	WMP, SMP, chilled dairy items, yogurts, yogurt whey drinks, fermented milk, desserts and other
Kerry Ingredients, Ireland	Manufacturer, importer and exporter	Whey/milk modified milk
Kraft Foods, U.S	Manufacturer	Philadelphia cream cheese
Nestle, Switzerland	Manufacturer	SCM, sterilized creams, caramel toffee spread, sterilized dairy cake fillings, ice cream, flavored milk, infant formula, and other
Parmalat, Brazil*	Manufacturer	SCM, cream, sterilized dairy desserts, imported ice cream, UHT milk and flavored milk
Pepsico, U.S.	Manufacturer	Flavored milk
Bongrain, France	Manufacturer, importer and exporter	Cheeses
Schreiber, U.S	Manufacturer, importer and exporter	Processed cheese
Unilever, UK and Netherlands	Manufacturer	Ice cream
Yakult, Japan	Manufacturer	Fermented milk

Source: [57, pp. 61–62].

*Parmalat Brazil is no longer affiliated with the former parent Italian company.

be used to produce Nestle's branded dairy and other food products to meet expected demand increases in Brazil. It is not clear how the plant figures into DPA's dairy exporting plans.

SERLAC. SERLAC was the first Brazilian trading company to export the country's dairy products (mostly milk powder) under the Brazilian Dairy Board brand [24, (11/17/03), p. 11]. SERLAC initially included five major dairies and cooperatives: Itambé, Confepar, CCL (Paulista), Embaré and Ilpisa. In the early to mid-2000s, SERLAC focused mainly on selling milk powder to Algeria, Morocco, Libya, the Middle East and Latin America.

In late 2007, SERLAC evolved into a joint venture supported by Sertrading S/A and Itambé, after Itambé bought out the interests of the other four partners. Itambé described the history of SERLAC and purpose of the Sertrading-Itambé joint venture as follows [40, p. 1 of Serlac Insert]:

We were created to manage and coordinate dairy product exports and imports, working with different sorts of markets. We are the largest genuinely dairy product exporter, operating in more than 60 countries in the Americas, Asia, Africa, and the Middle-East. Our company played a fundamental role in integrating Brazil into the international dairy product market. We turned the country into a new supply alternative and a potential and permanent market player. We provide our clients with high quality commercial, financial and operational services, as well as technical expertise on products and . . . [their] uses based on in-depth experience in foreign trade and international dairy product markets.

It is not fully clear why Itambé became the only dairy processor to export dairy products through SERLAC. However, an Embaré official said that he thought the return for his firm was too low to compensate for the 5 percent handling charge levied by SERLAC for handling export sales. The dissolution of a multi-firm

export trading organization is not unusual. As individual firm members of a multi-firm export trading company gain marketing proficiency, they often opt to market products on their own to avoid the complexity involved in operating through a multi-firm exporting company.

Itambé. This federated cooperative—which is owned by 29 local cooperatives—is probably the second largest milk processor in Brazil. However, the exact ranking of Brazil’s dairy processors is now uncertain given the emergence of Perdigão as a major dairy processor. Itambé’s six dairy plants in the Minas Gerais and Goiás states produce the most complete line of dairy products in Brazil. Itambé is expanding investments to increase production of milk powder and SCM for export. Among Itambé’s noteworthy investments is a new milk powder plant built near Uberlândia, with capacity to process about 1.2 million liters of milk per day. The new plant will manufacture products mainly for export.

Itambé has the reputation of being efficiently-managed. Indeed, in Brazil’s dairy industry where many small and medium-size cooperatives are experiencing financial trouble, Itambé is described in favorable terms as a successful cooperative that is run like a corporation.

Itambé President, Jacques Gontijo Alvarez, in an interview conducted by the study team, described the firm’s most difficult challenge, as being “short of the capital” needed to be competitive with large multinational firms such as Nestle and Parmalat. To cope with this challenge, Itambé has chosen to transform itself into a cooperative/PLC, which would ultimately sell shares on Brazil’s stock market. One use of the capital raised as a cooperative/PLC will be to expand processing operations in southern Brazil where milk prices are lower. Thus, Itambé will join several Irish dairy cooperatives (e.g., Kerry Group, Glanbia and Dairygold) in moving to cooperative/PLC status to raise capital and achieve other objectives [12].

New Entrants: Perdigão and Sadia. These two firms, which previously were primarily involved in beef, pork and poultry processing, have become important players in Brazil’s dairy processing industry in the past two

years. Both are large: Perdigão had gross revenues of 7.8 billion reais in 2007 (about US\$4.22 billion) [17]. Sadia’s gross sales totaled US\$5 billion in 2007 [52].

The strategic behavior of Perdigão and Sadia prior to their entry into dairy processing in Brazil has an unusual history, as noted below [47, p. 1]:

Twelve months after a hostile takeover attempt, in which Sadia tried to buy Perdigão, Brazil’s top two poultry (and meat) producers reversed positions. Perdigão passed Sadia when it finalized an acquisition of Eleva Alimentos in February . . . The unsuccessful takeover attempt in 2006 spurred Perdigão to revise its business strategies and enter an accelerated growth mode with a goal of strengthening the company and reducing vulnerability for future takeover bids. To insure survival, the company began aggressively pursuing growth domestically and within the global market. Focusing on different business areas and not just meats, and supported by a significant investment program, Perdigão went shopping.

Perdigão’s acquisition of Batavia, one of the firm’s most noteworthy acquisitions in Brazil’s dairy processing business, is described below [17, p. 7]:

In November (2007), Perdigão acquired full capital control of Batavia, following the completion of agreements with the Agromilk, Castrolanda, Batavo and Capal for the acquisition of the remaining 49% stake held by these cooperatives in the company’s capital stock. The business was worth a total of R\$155 million. Perdigão had held a majority stake in Batavia (51%) since mid-2006.

In June 2008, Perdigão further increased its investments in Brazil’s dairy business when it announced that it would spend 65 million reais (US\$39.7 million) to build a new powdered milk plant in Rio Grande do Sul [29].

Sadia’s entry into Brazil dairy processing industry has emphasized the cheese business. This is a logical focus partly because Sadia uses cheeses that the company now produces in its pizza products.

Sadia announced its entry into a major joint venture with Kraft in 2008, which Nasser described as follows [46, pp. 1–2]:

U.S. company Kraft and Sadia S.A. . . . have established a joint venture for the production, trade and distribution of cheese under the brand Philadelphia, produced by Kraft, together with cheeses and pates produced by Sadia. The announcement of the joint venture . . . forecasts initial investment of 30 million Brazilian reals (US\$17.8 million) in the Kraft unit in Curitiba (capital of the southern Brazilian state of Parana). The beginning of activities of the new company is forecasted for the second half of August 2008.

Sadia's joint venture with Kraft is part of a strategy for remaining competitive with Perdigão in Brazil's dairy business, as explained below [46, p. 2]:

. . . This joint venture is one more Sadia step in the direction of diversification of its activities. This way, it expands its production scale and competitiveness, getting ready to face giants in the sector, like Perdigão. The main Sadia competitor has been operating in the dairy sector since it purchased Batavia . . . in 2006. In the following year, Perdigão became the leader in the UHT milk sector after purchasing Eleva in the southern Brazilian state of Rio Grande do Sul. The operation placed Perdigão ahead of Sadia in revenues and market value.

Perdigão and Sadia both have long-standing exporting operations associated with their meat sales in many countries. Presumably these export market channels could be put to profitable use for dairy exporting if conditions warrant.

While Perdigão and Sadia had incentives to acquire other businesses as part of growth strategies, it is somewhat unusual for meat processing firms to enter the dairy processing business. Various explanations were reported to the study team for this strategic behavior, including the following:

- Expertise gained in processing and marketing meat products can be employed in the dairy business.
- Personnel with specialized skills in dairy product manufacturing and marketing can be hired by Perdigão and Sadia to handle tasks that the meat companies are not equipped to carry out.

- Existing milk plants—especially UHT milk plants—were available to purchase.
- Producer milk supplies accompanied the plants purchased.
- Diminishing financial returns were being encountered by the firms in meat processing, marketing, and exporting. Dairy processing and marketing was regarded as a higher return alternative than additional investments in the meat business.
- Cheese processing businesses were considered to be attractive investments partly because the cheese could be used in pizzas produced by the firms.

While these points support the entry of the meat companies into dairy processing, one caveat should be noted. In part, the meat companies entered dairy processing by purchasing UHT milk companies. Several dairy industry officials interviewed by the study team characterized the efficiency of the plants and quality of the products produced in the acquired UHT milk companies as being poor.

Other Brazilian firms that previously exported dairy products through SERLAC and that might be expected to expand dairy exports include those discussed below [39, pp. 41–49]:

- **Confepar.** This is a large cooperative located in northern Parana state. Confepar's domestic sales (marketed under the Polly and Confepar brands) include UHT milk, pasteurized milk, flavored milk, whey dairy drinks and WMP. The cooperative, which is one of the principal suppliers of bulk milk powder in Brazil, is expanding its exporting capabilities.
- **CCL (Paulista):** After the sale of the chilled dairy products division of Leite Paulista to Danone in 2000, CCL continued to produce pasteurized milk, butter, fresh cream, WMP and SMP using the Paulista trademark under license, and UHT milk and doce de leite using the Long brand name. CCL has a modern factory in Itumbiara, GO, which manufactures milk powder, butter, and UHT milk. This firm, which was purchased by Perdigão in 2007, did not

appear to be gearing up to expand dairy exports substantially prior to its acquisition by Perdigão. Whether this focus will change under the new ownership is unclear.

- **Embaré:** Headquartered in Minas Gerais, Embaré was the seventh ranked Brazilian dairy in terms of milk acquisition in 2007. Embaré's principal product is milk powder, followed by toffees (exported to 40 countries), and SCM. In mid-2005, Embaré began to operate a new SCM plant with capacity to produce 36 thousand tons per year. The firm is investing to increase its production capacity for milk powder and SCM, with an eye to becoming an early mover in expanding exports of these products.
- **Ilpisa:** Ilpisa operates production plants in three Brazilian states. Ilpisa acquired certain plants from Fleischmann Royal Nabisco (Kraft) when Kraft sought to exit from the dairy business in Brazil. This firm focuses heavily on selling UHT milk products, yogurt, cream and butter in the domestic market.
- In addition to these companies that once comprised SERLAC, **Sudcoop** is another Brazilian firm that might become more prominent in dairy exporting [39]. Headquartered in Parana state, this firm operates five dairy plants and one meat processing plant. The processor sells UHT milk, pasteurized milk, yogurt, dairy drinks, butter, cream and several types of cheese under the Frimesa brand. In 2004, Sudcoop exported about 46 percent of the 1,800 tons of cheese that it produced to Pizza Hut subsidiaries in South Korea, Chile, and other countries. Sudcoop's cheese exports consist mainly of mozzarella cheese.

Synopsis

A mixed picture emerges regarding the capacity of Brazilian firms to expand dairy exports. There are several positive developments, which might foster expanded exports of Brazilian dairy products:

- Brazil's milk production, which is likely to grow by about 4 percent per year, is increasing more

rapidly than domestic consumption of dairy products.

- WMP production—a major Brazilian dairy export—is growing rapidly, doubling from 2000 to 2007.
- A number of major multi-national firms operating in Brazil have the experience and exporting networks needed to expand dairy exports if profit prospects warrant.
- DPA partner, Fonterra, has the capacity to expand Brazilian dairy exports substantially if profit prospects and other developments are favorable. Fonterra's capacity results from experience the cooperative has gained while becoming the world's largest private dairy exporter.
- Certain other large and small dairy firms in Brazil are gearing up to expand exports—apparently in the belief that supply conditions in Brazil and world demand conditions may call for such actions. Itambé is prominent in the large firm group.
- Firms previously involved mostly in the meat business (especially Perdigão and Sadia) have entered dairy processing in Brazil. These firms have extensive meat exporting experience and exporting infrastructure, which could be used to advantage to expand Brazil's dairy exports.

On the negative side of the export prospects is Brazil's strong currency, the real. According to reports received by the study team, the strength of the real already has curbed exports of certain Brazilian dairy products, forcing some companies to divert dairy products previously exported to the domestic market. And it is unclear that the real will weaken substantially anytime soon. Lower farm milk prices probably will be needed to permit expanded dairy exports if the real remains near its current value relative to the U.S. dollar. In addition, Brazilian firms do not have an export culture for dairy products. Thus, the firms will need to continue to work on establishing a tradition for Brazil as a supplier of high quality dairy products in Africa, the Middle East and Asia.

V. AGRICULTURAL AND TRADE POLICIES IN BRAZIL

This section discusses Brazil's agricultural and trade policies, emphasizing how those policies affect Brazil's dairy industry. The analysis focuses on identifying economic implications of existing policies and on how Brazil's agricultural and trade policies have helped to transform the country into a major agricultural exporter.

Agricultural Policy Eras

Brazil's agricultural policies have evolved from measures featuring massive government intervention in agriculture via price supports, government purchases and storage from the mid-1960s through the early 1980s to programs involving mostly subsidized credit for the agricultural sector in the mid-2000s (Table 13).

As a result of the evolution in policies, government support for agriculture in Brazil declined to the equivalent of only about 3 percent of farm receipts in

2005. In the mid-2000s, the comparable figures were 2 percent for New Zealand, 4 percent in Australia, 8 percent in China, 18 percent in the U.S. and 34 percent in the European Union [7]. Unilateral reductions in trade barriers accompanied the evolution in agricultural policies. Consequently, Brazil's average applied tariff on agrifood products fell to 12.5 percent in the mid-2000s [7].

Milk prices in Brazil were decontrolled under policy measures adopted in the early 1990s. Government farm milk prices controls were lifted in late 1990 and consumer milk prices were eliminated in late 1991, ending a long history of government intervention in Brazil's dairy sector [24 (11/30/95), p. 6]. The only government dairy programs remaining in effect immediately after these changes were those limiting imports of subsidized dairy products and programs to stimulate demand through government purchases of dairy products for distribution to low-income people [24, (11/30/95), p. 8].

TABLE 13. Evolution of Agricultural Policies in Brazil

Period	Nature of Policies
Mid-1960s to Early 1980s	Consisted of extensive government intervention in agricultural commodity markets primarily by means of price support mechanisms, including government purchases and storage of excess supplies. Rural credit subsidies also were employed.
Late 1980s	In response to the debt crisis of the 1980s, the Brazilian government reduced support to farmers and reviewed agricultural policy goals. This led to policies that departed from the import substitution measures for a host of products that permeated agricultural policies from the 1960s up to the late 1980s.
Early 1990s	Economy-wide structural reforms further reduced the distortions produced by Brazil's agricultural policies by eliminating export taxes and price controls, deregulating and liberalizing agricultural commodity markets, unilaterally reducing trade barriers, and introducing private instruments for agricultural financing.
Mid-1990s	Measures to facilitate land reform and family farming objectives were introduced in 1995. About 500,000 new family farms were established on expropriated land. Additional measures to promote family agriculture were adopted including subsidized credit, capacity building, research programs, and extension services.
Early to Mid-2000s	Brazil increased its financial support to the agricultural sector via government credit. The government credit system provides financial resources to farmers and agribusinesses at subsidized, fixed low-interest rates through production and marketing programs, investment programs and specialized programs for agribusinesses.

Sources: [7, 48 and 21].

Deregulation of Brazil's milk prices created incentives for increased foreign direct investment in Brazil's dairy industry beginning in about 1995. Foreigners investing in Brazil's dairy industry after the mid-1990s included Danone (France), Parmalat (Italy), Fleischman Royal (U.S.), Milkaut (Argentina), Mastellone (Argentina), Royal Numico (Netherlands), Nestle (Switzerland) and New Zealand Dairy Board-Fonterra (New Zealand) [24, (10/25/02), p. 3].

Brazil's Credit Subsidies. In recent years, Brazil's government has employed a complex set of credit subsidies to foster development of various farm and agribusiness sectors. A few credit subsidies that focus mainly on Brazil's dairy sector are discussed below.

USDA-FAS reported in 2002 that the government's Pro-Leite fund provided about US\$74 million for programs to increase milk production and milk quality in Brazil [24, (10/25/02), p.2]. The Pro-Leite fund was used mainly by milk producers in the Center-West to increase their productivity.

In 2005, Brazil's National Bank of Economic and Social Development made available US\$43 million in credit to finance new investments for powdered milk production. This government credit program supplemented domestic and private sector capital, bringing total investments for powdered milk production to US\$100 million [24, (10/18/05), p.8].

Brazil expanded the amount of subsidized credit available to farmers in the mid-2000s under some 23 different programs. According to the USDA's Economic Research Service (ERS), government agricultural credit administered by the Brazilian Ministry of Agriculture and disbursed through the National System of Rural Credit rose to US\$13 billion in 2004/2005, up 48 percent from a year earlier [21]. The National Rural Credit System provided financial resources at subsidized, fixed low-interest rates through production and marketing programs (60 percent of total), investment programs (30 percent of total), and programs for financing agribusinesses at market rates (10 percent of total).

In the mid-2000s, subsidized interest rate loans were made available to Brazilian farmers under government programs at interest rates of 8.75 percent to 12.75 percent. The higher interest rates were charged farmers with larger annual incomes. Subsidized loans

made available under the investment programs could be used for a host of purposes, including development of milk production facilities and purchase of milk production equipment. These interest rates were substantially lower than the then current average market rates of 16 to 20 percent per year for farm loans.

Brazil's government announced in April 2006 an emergency credit program of nearly US\$8.0 billion to alleviate farmers' debt problems caused by droughts in the previous two growing seasons, appreciation of the real relative to the U.S. dollar, and higher production costs. The measures announced fell mainly in three program areas: (a) additional credit to support the marketing of the current year's crops, (b) relaxation of payment terms for the previous year's investment and production loans, and (c) crop insurance. These measures represented the second year of emergency credit assistance to Brazilian farmers [24, (5/2/06)].

Brazil announced in June 2007 a new Agricultural and Livestock Plan for the 2007/2008 season, which allocates US\$30.5 billion in total credit for the sector, up 16 percent from the year-earlier figure. The plan makes available 8.75 percent, subsidized loans to dairy farmers and processors under the following programs [24, (10/18/07), p. 4]:

- **Moderagro II:** For the 2007/2008 marketing year, nearly US\$1.0 billion in funds were allocated for the program. The program was initially designed for pasture improvement and was recently modified to include soil erosion reduction programs and conservation of lowlands. Moderagro II also incorporated a previous program called Pro-Leite, which is designed to modernize milk producer's operations, provide incentives for cooling milk at the farm, transportation, and silage production.
- **Moderinfra.** This program helps dairy producers to build or rebuild silos and warehouses on their farms. The measure was recently modified to include irrigation systems. Brazil's government allocated US\$263 million for the program for 2007/2008.

C. Phillips of Dairy Australia observed that while Brazil's farmers have access to subsidized and emergency credit, credit remains a problem for the country's farmers [49, p. 6]:

[Brazil's] interest rates are as high as 20%. While family farms can access interest rate subsidies for some borrowings, one result of the high cost is that borrowing tends to be short-term and predominantly for production expenses rather than for capital investment for expansion. Access to capital also remains limited because of perceived credit risk particularly with small scale farms and the undeveloped financial sector in rural areas.

Brazil's government has pinned its hopes for expanded infrastructure investment to improve transportation of agricultural products partly on a public-private partnership created in the mid-2000s. Brazil's government hoped that the program would lead to yearly investments in infrastructure of US\$6.5 billion, 60 percent more than then current public investment [24 (14/12/06), p. 2]. The program involves government guarantees of private investment projects. The initiative necessitated the establishment of several independent bodies to evaluate, authorize and guarantee projects, producing lengthy delays in the startup of the program. It is unclear how effective this public-private initiative will be for fostering needed improvements in agricultural infrastructure.

Effectiveness of Brazil's Agricultural Policies. How effective are Brazil's agricultural policies for achieving policy objectives? The *Economist* characterized the problems facing Brazil's agricultural sector as follows in its 2005 Special Report on Brazilian Agriculture [16, p. 73]:

Brazil's real interest rates are the world's highest; [and] its system for transporting commodities befits a third-world backwater, not an agricultural super-power.

The study team's experience in Brazil suggests that the *Economist's* comments overstate the credit problems facing Brazil's dairy farmers. Brazil's farm interest rates have declined in recent years. For example, an agricultural banker interviewed by the study team said that dairy farm expansion loans for credit-worthy borrowers in Minas Gerais carried only a 6.75 percent nominal interest rate in June 2008. However, the banker indicated that the repayment period on the expansion loans of five to six years is too short for many dairy-farm borrowers. He also added that the

collateral for many farm loans was of limited value to a lender because of government restrictions on foreclosures. Hence, the dairy farm credit picture in Minas Gerais, at least, is mixed, and we expect the same situation exists in other states.

Infrastructure is also more varied than depicted in the quote. Roads, a key component of Brazil's infrastructure, differ greatly in quality. Main highways in São Paulo and Minas Gerais—important dairy states in Brazil—are similar to main roads found in the U.S. and Western Europe. By contrast, some secondary roads in these states do fit the description of those found in a third-world backwater.

Dr. Gilman Viana Rodrigues, State Secretary of Agriculture for Minas Gerais, gave the following priority ranking for improvements in Brazil's agricultural infrastructure during an interview conducted by the study team:

1. Railroads
2. Ports
3. Energy
4. Highways
5. River barges

If implemented, these priorities would help to foster development of Brazil's dairy industry and increase the country's ability to export dairy products. However, the relatively low ranking given to highway improvements is noteworthy. Infrastructure improvements that emphasize upgrading of railroads and ports would be more helpful to soybean, corn and wood product interests than to the dairy industry.

The Organisation for Economic Co-operation and Development (OECD) claimed that Brazil's government focuses an insufficient amount of resources on infrastructure, research and extension in a 2005 policy review [48, p. 1]:

. . . Brazil provides much lower support to its agricultural sector than most OECD countries. However, a large and increasing share of that support is provided in the form of credit subsidies; support which could be more productively oriented to areas such as research and extension, training, and the development of rural infrastructure.

Portions of the OECD's observations on the effectiveness of credit subsidies appear valid. The agricul-

tural credit subsidies represent a form of industrial policy that involves “picking winners” to receive the benefit of subsidies. Picking winners is never easy and is undoubtedly difficult to do effectively in Brazil’s complex economy.

Brazilian economist, Marcos Jank, issued a more sweeping criticism of Brazilian agricultural policies in a 2006 article [41, p. 2]:

Currently, government resources dedicated to agriculture are distributed through over a hundred programs, allocated to four federal ministries: Agriculture, Agrarian Development, Fisheries, and Environment. The curious part, however, is that the most serious difficulties now affecting this sector are not controlled by any of these ministries, all of which have become mere firefighters attempting to douse the flames of macro-inconsistencies that cause most of the harm. These [harmful macro-inconsistencies] are (a) the exchange rate volatility, with Brazil’s real gaining ground steadily in recent months against the U.S. dollar, and forcing down earnings for Brazilian farmers; (b) infrastructure bottlenecks, (c) the lack of clearly defined property rights and inconsistencies of the legal system; and (d) the lack of a more aggressive trade policy, dedicated to opening up markets through regional and bilateral trade agreements.

A Summary Observation on Brazil’s Agricultural Policies. Partly as a result of macroeconomic reforms, Brazil’s real interest rates have declined since the *Economist* issued its Special Report. However, it is unclear whether the country’s transportation infrastructure for agriculture has improved substantially from the situations described by the *Economist*, the OECD and Jank. The property rights and legal system issues are probably matters that will require a long time to fully resolve. Trade policy issues are discussed below.

Brazil’s Trade Policies

The partial abandonment of import substitution policies and elimination of many domestic subsidies gave Brazil’s domestic firms strong incentives to export. Brazilian business-economic analysts, Chaddad and Jank, claim that the growing international competitive-

ness of Brazil’s agrifood sectors can be attributed in part to the following developments [7, p. 1]:

. . . Investments in tropical agricultural research and availability of agricultural credit, . . . [have] caused significant productivity gains since the 1970s. The technologies that made the expansion into the cerrado region in the Brazilian Central-West—in soils that are distinctly inferior to those in Argentina, the U.S. Corn Belt and Southern Brazil—resulted from public investments in agricultural research . . . Other factors also contributed to the competitiveness and growth of the agrifood sector in Brazil, such as relative stability after 1994 and significant reductions in government intervention and trade barriers.

These developments helped to transform Brazil into the world’s third largest agricultural exporter in the mid-2000s, trailing only the U.S. and the European Union. Brazil also recorded a substantially larger agricultural trade surplus than the U.S. in this period.

As Brazil’s exports have grown, the composition of those exports has changed to emphasize soybeans, corn, sugar, ethanol and meats (see Figure 5 in Section II). However, exports of traditional tropical products such as coffee and orange juice have remained large. And, as noted earlier, Brazil became a net exporter of dairy products beginning in about 2004. Perhaps the most noteworthy change was the overall increase in Brazil’s agricultural and forest product exports, which more than doubled from 2001 to 2007.

Chaddad and Jank point out that despite favorable developments and the availability of labor and natural resources, Brazil still faces significant external constraints to growth of its agrifood and agricultural exports [7, p. 1]. Specifically, trade barriers and subsidies to domestic producers and exporters—especially in developed countries—adversely impact Brazil’s agrifood exports.

Brazil is a member of the Mercosur and the World Trade Organization (WTO). Both trade organizations have helped Brazil improve the country’s trading position and lessen the impact of foreign trade barriers and subsidies.

Brazil and the Mercosur. Brazil and Argentina signed 12 commercial protocols in 1986 as a step

toward bringing the economies of the two countries closer together [38]. As a follow-up to the protocols and other agreements, Brazil and Argentina signed a treaty of Integration, Cooperation and Development in 1988 that set the stage for establishment of a common market between the two countries within 10 years. The agreement envisioned the gradual elimination of all tariff barriers between the countries and the harmonization of macroeconomic policies of both nations. It was also established that the common market would be open to all other Latin American countries.

Uruguay and Paraguay subsequently joined Brazil and Argentina in a treaty that was signed by the four countries on March 16, 1991 in Asuncion, Paraguay to create a common market known as the Southern Common Market (Mercosur). Chile and Bolivia became associate members of the Mercosur in 1996 and 1997, respectively.

The objectives of the Mercosur include the following [38]:

- Fixing of a common external tariff and adopting a common trade policy with regard to nonmember states.
- Coordination of macroeconomic and other policies of member states relating to foreign trade, agriculture, industry, taxes, monetary system, exchange and capital, services, customs, transportation and communications.
- Commitment by member states to make the necessary adjustments to their laws to allow for the strengthening of the integration process.

Under the Mercosur, the target date for the end of tariffs and non-tariff trade barriers between Brazil and Argentina was December 31, 1994. The comparable date for the end of tariffs and non tariff barriers relating to Uruguay and Paraguay was December 31, 1995.

While the Mercosur calls for the lifting of tariffs and non-tariff barriers in member nations, the agreement allows each member nation to maintain an exception list for sensitive products. The exception list designation would allow tariffs (in addition to the common external tariff) to be applied to imports of certain products from Mercosur member countries. USDA-FAS reports that Brazil designated milk powders, whey powder and certain cheeses for the exception list under Mercosur regulations [24, (10/18/07)]. However, it

is unclear whether Brazil actually applies the tariffs authorized under the exception list and whether the exception list tariffs exclude any dairy imports from other Mercosur countries. Indeed, Brazilian dairy industry officials interviewed by the study team knew of no recent instances where dairy product imports from other Mercosur countries were impeded by tariffs associated with the dairy exception list.

Brazil's imports of UHT milk and cream, butter, and butteroil from Mercosur countries carried a zero tariff in 2007. The common external tariff applied to 2007 imports of these products from non-Mercosur countries ranged from 12 to 16 percent.

Brazil's Foreign Trade Board conducted dumping investigations which caused additional tariffs (over and above normally applicable tariffs) to be levied on imports of certain dairy products from New Zealand, the European Union and Uruguay [24, (10/18/07)]. These tariffs ranged from 3.9 percent to 16.9 percent. According to Brazilian dairy industry officials interviewed by the study team, this action limited Brazilian imports from these countries and helped to prevent Brazil's dairy industry from being harmed by subsidized foreign competitors.

C. Phillips of Dairy Australia reported the following about dairy product exports of Mercosur countries in the mid-2000s [49, p. 4]:

On a milk product basis, around half of Mercosur dairy exports consist of milk powders (mainly whole milk powder but also whey powders and skim milk powders). Food preparations account for a further 19% of trade while cheese exports and condensed milk, respectively, make up 11% and 5% of total exports . . . From an international market perspective around 50% of the above exports are sold within the South American region. For example, Argentina and Uruguay are major suppliers of milk powders and cheese to Brazil . . .

Brazil and the World Trade Organization. Brazil joined the WTO in 1995 when the WTO succeeded the General Agreement on Tariffs and Trade. By joining the WTO, Brazil agreed to extend market integration from a regional level under the Mercosur to a global level [4, p. 3].

Brazil—which sought expanded exporting opportunities—had strong incentives to become a WTO mem-

ber for reasons noted in the following excerpt from the OECD's review of Brazil's agricultural policies [48, p. 2]:

Having substantially liberalized its own agricultural policies, the main source of future benefits to Brazil is reforms in other countries, where access to OECD country markets is the most important issue. Brazilian exporters are impeded by high tariffs in key markets, tariff escalation according to the degree of processing for several important commodities, unfavorable treatment under trade preference schemes and tariff-rate quota systems, and significant non-tariff measures (notably for live-stock products).

Brazil undoubtedly was encouraged by measures in the Uruguay Round WTO Agreement, which became effective in 1995. These included provisions to reduce trade-distorting domestic support, increase market access, and reduce export subsidies. For example, under the market access provisions of the Uruguay Round Agreement, countries were required to convert all non-tariff barriers (quotas, import licenses, etc.) to tariffs and reduce the tariffs by an average of 36 percent over six years, with a minimum reduction of at least 15 percent from 1986–88 base levels. In addition, countries were required to ensure that current access for agricultural imports was maintained and to open minimum access opportunities in cases where there was little or no trade.

The Doha Round WTO negotiations, which began in 2001, were expected to open additional agricultural markets for Brazil and other exporters of agricultural products. While the Doha Round negotiations continue, there is little prospect for completing this negotiating round in the next year or two, if ever. Ironically, one reason for the lack of progress in the negotiations is that the U.S.—which expected to gain access to additional agricultural markets under the Uruguay Round Agreement—saw Brazil obtain much of the additional market access made possible by the agreement. Thus, many U.S. agricultural groups have opposed or provided only tepid support for the Doha Round WTO Agreement partly because they envision getting little additional market access for U.S. agricultural products under such an agreement.

While Brazil is unlikely to gain additional market access in the near future via the Doha Round, the country may secure additional benefits through the WTO dispute settlement machinery. Indeed, Brazil secured gains under this mechanism through challenges to the U.S. cotton subsidy program and the EU sugar program in 2002. The EU modified its sugar program in a relatively short time to eliminate objections raised by the Brazilians. The U.S. response to the Brazilian challenges has been more limited and slower.

Brazil's challenge to U.S. agricultural policy emphasized objections to the U.S. cotton program. Hudson, et al. summarized Brazil's challenge to four components of U.S. cotton programs and related policies as follows [35, p. 2]:

First, U.S. domestic support for cotton causes "serious prejudice" to Brazilian producers by depressing or suppressing the world price of cotton and results in a larger U.S. share of the world cotton market. Second, U.S. export credit guarantees are an export subsidy. Third, the Step 2 payments are both an export subsidy and an import substitution policy. Finally, tax credits/deferrals given for cotton to U.S. exporters amount to an export subsidy. The United States attempted to limit the scope of the complaint to cotton, but Brazil successfully argued to include all other commodities in the argument related to export credit programs as well.

The term "serious prejudice" appearing in the quote occurs when a subsidy (a) displaces or impedes exports or imports, (b) results in significant price undercutting, suppression, or lost sales, or (c) results in an increase in the subsidizing country's market share.

The WTO dispute resolution panel ruled in favor of Brazil on most points in the challenge and an appellate body report mostly confirmed the initial panel's rulings. However, the WTO found that Brazil had failed to establish that tax credits to exporters were export subsidies.

The U.S. eliminated the Step 2 program for cotton in August 2006 [33, p. 2]. This program had made payments to domestic cotton users and exporters based on the difference between U.S. and world prices. A WTO panel found that the program was both a prohibited import substitution subsidy and a prohibited export subsidy.

Brazil's challenges to U.S. cotton programs indicate that the USDA's GSM 102 (short-term export credit guarantees), GSM 103 (intermediate-term export credit guarantees) and the Supplier Credit Guarantee constitute export subsidies that are inconsistent with the WTO's Agreement on Agriculture and Agreement on Subsidies and Countervailing Measures [53]. The WTO cotton dispute panel found that U.S. cotton export credit guarantee programs were effectively export subsidies because the premiums and other outlays for the programs failed to cover long-run operating costs.

The WTO's findings regarding Brazil's challenges to credit guarantee programs are potentially important because U.S. dairy exporters have employed similar programs. While the export credit programs may not be of much concern to U.S. dairy exporters under buoyant market conditions, the export credit programs may become important if market conditions become depressed and exporters seek to again use them. The WTO challenges make it difficult to predict whether export credit guarantee programs for dairy products and other U.S. agricultural commodities will survive and, if so, in what form. But it is likely that the export credit programs will have a short life expectancy if a Doha Round agreement is ever reached, since these programs are likely to remain targeted for elimination under that agreement.

Brazil initiated a new challenge to U.S. farm programs under the WTO dispute settlement machinery in July 2007. The claim in the new challenge is that in several recent years the U.S. has exceeded the \$19.1 billion limit on trade-distorting domestic support that the U.S. agreed to observe under Uruguay Round's Agreement on Agriculture [37].

Canada in November 2007 requested that a WTO dispute settlement panel be established to consider a claim against the U.S. similar to the one made by Bra-

zil. In support of its request for a dispute settlement panel, Canadian officials claimed that "... when trade-distorting domestic support is properly accounted for under the WTO Agreement on Agriculture, the United States exceeded its WTO commitment in 1999, 2000, 2001, 2002, 2004 and 2005 [32, p. 4]."

It is unclear what will come of Brazil's latest challenge. But it is evident that Brazil will use the WTO's dispute settlement machinery in attempts to achieve gains that are likely to slip out of reach as a result of an impasse in the Doha Round WTO negotiations. This will be a lengthy, expensive and time-consuming process. However, Brazil will benefit from its experience as a litigator on such matters.

Synopsis

Brazil's agricultural and trade policies were instrumental in transforming the country into a major agricultural exporter. Whether Brazil's agricultural policies will produce substantial increases in dairy exports depends partly on how much the government's credit subsidies foster substantial increases in milk production and expand Brazil's milk processing capabilities. A host of factors, including Brazil's strong currency, poor coordination of policy programs, and infrastructure problems will limit exports of the country's dairy products.

The impasse in negotiations under the Doha Round of WTO negotiations will prevent Brazil from obtaining gains in market share similar to those secured by Brazil under the Uruguay Round WTO Agreement. Brazil is likely to seek to open additional foreign markets for the country's agricultural products through aggressive use of the WTO's dispute settlement machinery. Challenges to U.S. export credit guarantees under the dispute settlement machinery could adversely impact U.S. dairy exports at a future time.

VI. CONCLUDING OBSERVATIONS: FUTURE OF THE BRAZIL DAIRY SECTOR

In this section, we attempt to summarize what we have learned about the potential for sustained future growth in Brazil's dairy sector and Brazil's potential for expanded dairy exports.

Strengths, Weaknesses, Opportunities and Threats

As a starting point, we will use the outcome of a seminar held with about 30 graduate students enrolled

in the College of Veterinary Medicine at the Federal University of Minas Gerais. During the seminar, we engaged students in a SWOT analysis—Strengths, Weaknesses, Opportunities and Threats—pertaining to Brazilian dairying.⁹ Specifically, we asked students to identify internal strengths and weaknesses of the current dairy production system and external opportunities for and threats to future sector growth. The students had strong backgrounds and experience in dairy, some both in Brazil and in other countries, and participated enthusiastically in the process.

The results of the SWOT analysis are summarized in Table 14. We have previously discussed most of the factors that were identified in the process, but some clarification and elaboration is useful.

As strengths, participants noted relatively low costs for land, labor, forages and by-product feeds. These factors have yielded a significant competitive advantage

to Brazilian dairy farmers. But they have not been able to exploit this advantage because of historically low farm milk prices, something that, surprisingly, was not noted as a weakness. Indigenous dairy knowledge is seen as a strength, but we earlier noted that the indigenous knowledge of more than a million Brazilian dairy farmers is likely not compatible with modern dairy production practices.

Identified weaknesses included farm-level technical and managerial deficiencies and several broader issues. Weaknesses such as low reproductive efficiency, low milk production per cow, milk quality, disease control, poor labor skills and weak managerial capability reflect, in our judgment, the lack of a strong dairy extension programs. While educational programs are available from several sources, they are not coordinated and duplication appears to be a problem.

TABLE 14. SWOT Analysis Results, UFMG Veterinary College Graduate Students, June 25, 2008

Strengths	Weaknesses
Low cost labor	Low reproductive efficiency
Low cost forage	Low productivity (low milk production per cow)
Relatively low land prices, especially in the cerrado	Sanitary problems and tropical diseases
Readily available by-product feeds	Poor labor skills and training
Indigenous dairy knowledge	Weak farm management capabilities
Very large land base	Poor infrastructure
	Weak organization of producer coops
	Lack of a supportive agricultural policy
	Low consumer purchasing power
	Corruption
Opportunities	Threats
Milk quality can be improved	Market power of dairy processors
Income growth and related growth in consumption of dairy products	Off-farm labor opportunities draw labor away from dairy farms
Strong international markets for dairy products	Strong Real hurts exports
Increased processing capacity for whey	High prices for feed, petroleum products and fertilizer
High valued crops provide capital for expanding dairy farms and enhancing dairy productivity	Inflation
	More stringent environmental regulations

⁹SWOT analysis is a strategic planning tool initially used for assessing private business ventures, but which is now commonly applied to industry sectors and organizations [42].

The biggest infrastructure problem would seem to be secondary roads servicing dairy farms, most of which are unimproved. From our limited observation, milk pickup during the rainy season must be a major challenge. The lack of reliable electrical power is another major infrastructure problem impeding the growth of dairy farms that require electricity for milking, feed handling and other modern dairy farm activities.

The SWOT analysis confirmed our earlier observation that there are too many dairy cooperatives in Brazil and many are financially weak, poorly organized and poorly managed. We discussed the inadequacies of agricultural policies in a previous section. Participants emphasized that policies should encourage dairy growth by addressing price volatility, especially preventing milk prices from falling to levels that jeopardize the economic viability of progressive, well-managed farms. Low purchasing power was seen as a weakness that is diminishing for the overall population of Brazil but that continues to pose a problem for a large percentage of the rural population. The persistent low incomes of a relatively large group of rural consumers have also supported the informal milk sector and the sale of low-quality milk. Finally, participants also corroborated our previous observations about corruption.

The SWOT participants saw growth opportunities in both domestic and foreign markets. Internal income growth was expected to encourage domestic demand for dairy products and world market prices were anticipated to remain strong because of supply constraints in major dairy countries and sustained demand growth in developing countries. Participants predicted that recent high whey prices would induce more whey processing capacity, adding another value-added dimension to dairy processing.

Perhaps the most interesting dairy opportunity noted was the supportive nature of the Brazilian crop sector. We anticipated that participants would express concern about soybeans, sugar cane, coffee and other high-demand crops displacing pasture land and negatively affecting dairy. They resoundingly rejected our suggestion of that scenario, instead arguing that income from crop sales would promote dairy development by providing capital to diversified operations.

A mixed bag of threats to dairy development in Brazil was identified by participants. The market power

of processors was seen as depressing farm milk prices absent government intervention to promote competitive prices. Perhaps reflecting their veterinary training background, participants were confident that milk quality could be easily enhanced. They recognized the strong real as a threat to expanding exports.

Participants recognized the threat of higher input costs resulting from wide-scale promotion of renewable energy and the possibility of rapid inflation reoccurring and diminishing consumer purchasing power. They also saw environmental restrictions as possibly constraining growth in milk production.

Future Growth in Milk Production

The SWOT analysis provides an excellent summary of factors that will drive dairy development in Brazil and, in turn, influence Brazil's status as a dairy exporter. How these factors change in the future is very uncertain. But on net, the SWOT exercise supports our independent conclusion that there is a positive climate for continued growth in Brazilian milk production at rates comparable to recent experience. Milk production more than doubled from 1991 (14.2 million tons) to the forecast figure for 2008 (28.9 million tons), and year-to-year increases in milk production since 2005 have averaged 5.5 percent. We believe a somewhat more constrained rate of about 4 percent per year may be more plausible and certainly achievable absent a major deterioration in production incentives. In particular, a 4 percent growth rate assumes that milk prices do not return to their depressed levels at the beginning of the decade because of a collapse in world dairy prices, exploitation of producers by processors, government price controls, or other factors.

Future Growth in Consumption

A continuation of recent growth rates suggests a growing surplus for exporting. However, the key question is whether Brazil's milk supply will increase faster than domestic demand for dairy products.

Rough estimates of yearly demand growth for dairy products in Brazil can be made by adding a population growth figure (0.98 percent from Table 3) to the product of income growth and the income elasticity of demand for dairy products.

Real GDP growth (4.5 percent from Table 3) can serve as a proxy for income growth. iRIS Consulting quotes an income elasticity of demand of 0.39 for dairy products for Brazil [39, p. 112].¹⁰ Performing the arithmetic yields an increase in demand for dairy products in Brazil of approximately 2.7 percent per year. This figure suggests that Brazil's domestic milk production must increase by at least this amount before surpluses would be available for export.

Increases in per capita income may alter Brazilian diets in favor of dairy products, possibly making our demand growth prediction conservative. Similarly, enhanced government feeding programs to improve nutrition could stimulate internal consumption beyond what might be expected based on population and income growth. For example, Brazilian health authorities estimated internal milk demand based on adherence to dietary recommendations (Table 15). Resulting consumption in 2007 would be 39.3 million liters compared to 26.8 million liters produced, a 47 percent shortfall.

Future Growth in Dairy Exports

We projected Brazil's exportable dairy surplus to 2015 assuming a 4 percent annual increase in milk production and a 2.7 percent annual growth in inter-

nal demand. As a base for this projection, we used the FAS 2008 milk production forecast of 29.89 million tons and recent 2008 dairy trade forecasts made by Brazil's National Food Supply Company (COBAB) [55]. COBAB forecast 2008 dairy exports at 1 million tons milk equivalent valued at US\$750 million. Dairy import volume was not forecast, but import value was forecast at US\$200 million. Using the export value/volume ratio (0.75) as a proxy for the ratio of import value to import volume yields an import volume forecast for 2008 of 267,000 tons.¹¹ This implies net exports, or exportable surplus over consumption, of 733,000 tons milk equivalent in 2008. By subtraction, domestic consumption of 28.166 million tons milk equivalent was forecast for the 2008 base year.

We applied the annual population change (0.98 percent), income change (4.5 percent) and income elasticity (0.39) values noted above to project internal dairy consumption in 2015 assuming these values remained constant over the 2008–15 period. This yields consumption (including imports) of 34 million tons compared to production of 38 million tons for an exportable surplus of 4.0 million tons in 2015.

To place this number in context, 2005 net exports expressed in milk equivalent for leading dairy exporting countries as reported by FAO are noted in Figure 16.¹² The projected 4 million tons exportable surplus

TABLE 15. Brazil Internal Milk Demand Based on Dietary Recommendations

Age Range	Recommended Consumption liters/year	Population 2007	Demand (million liters/year)
Children (up to 10 years)	146	32,324,081	4,719
Adolescents (10–19 years)	256	36,318,893	9,298
Adults (20–69 years)	219	107,267,323	23,492
Mature (greater than 70 years)	219	8,076,994	1,769
Total		183,987,291	39,277

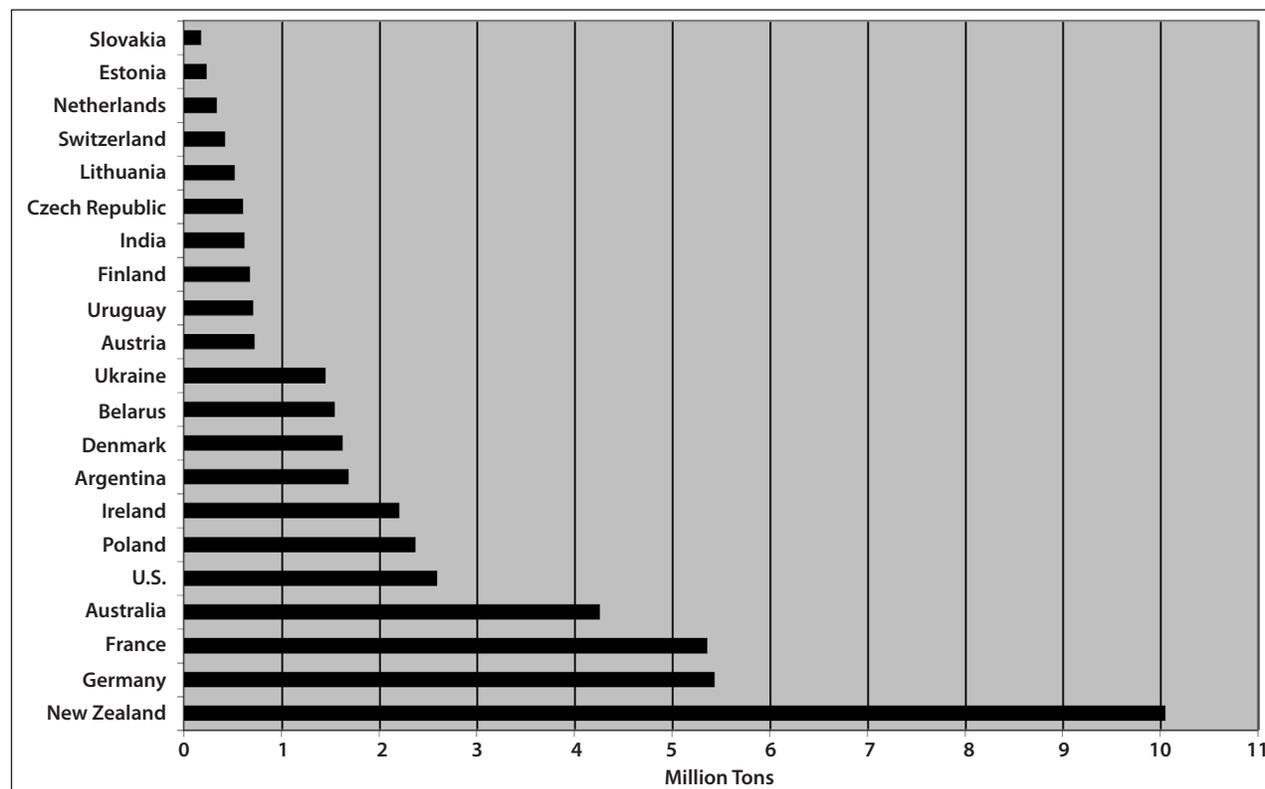
Source: Embrapa Dairy Cattle [19] citing Instituto Brasileiro de Geografia e Estatística (IBGE) as original source. Note population is IBGE estimate for April 1, 2007 (http://www.ibge.gov.br/home/estatistica/populacao/contagem2007/contagem_final/tabela1_1.pdf).

¹⁰This relatively low income elasticity of demand for dairy products may reflect Brazil's meat-oriented consuming habits.

¹¹The different composition of Brazil's dairy exports and imports makes this assumption admittedly tenuous.

¹²FAO is the only known source of milk equivalent dairy exports that uses a consistent methodology for converting dairy products to milk equivalent across countries. Unfortunately, the most recent FAO dairy trade data available are from 2005, prior to significant changes in world dairy markets that altered the values and rankings shown in Figure 16. Note that FAO reported net milk equivalent imports of 186,000 tons for Brazil in 2005 compared to the base (2008) net exports of 733,000 tons.

FIGURE 16. Leading Dairy Exporting Countries, 2005



Source: [22].

for 2015 is greater than that recorded for all but four of world's top dairy exporters in 2005.

To test the sensitivity of these projections to the assumptions employed, we generated exportable surplus using a range of values for milk production growth, income growth, and elasticity of demand.¹³ Figure 17 shows the relationship between exportable surplus in 2015 and the rate of growth in Brazilian milk production, using high, medium and low rates of growth in income and fixing income elasticity at 0.5.¹⁴

With low-income growth, exportable surplus is positive even if production increases at only 2.5 percent annually between 2008 and 2015. But at higher growth rates for income, internal consumption absorbs more of any production gain. At a 6 percent annual rate of income growth, a 3.75 percent annual production increase is needed to prevent a dairy trade deficit. At the other extreme, a 3 percent annual growth in income

and a 6 percent growth in production would yield exportable surplus of 10 million tons, placing Brazil at New Zealand's level of dairy exports in 2005.

Figure 18 shows the effect on projected 2015 exportable surplus of holding production growth constant at 4 percent per year and ranging income growth from 3 percent to 6.5 percent at high, medium and low values for assumed income elasticity of demand. Income growth less than 4 percent per year generates exportable surpluses between 2.5 and 5.2 million tons. But high income growth combined with high income elasticity of demand would spell net imports of dairy products.

Sensitivity analysis emphasizes the critical role of domestic consumption in determining Brazil's future status as a dairy exporter. Sustained economic growth would encourage expanded milk production but, at the same time, stimulate internal demand for milk and

¹³ We did not alter the population growth rate from 0.98 percent on grounds that population growth is more stable and predictable than income growth. Other factors held constant, lower rates of population change would increase exportable surplus over those noted in our projections and higher rates would decrease exportable surplus.

¹⁴ This is higher than the iRIS value used in our analysis but, in our judgment, closer to what can be expected in the future based on analysis of income elasticity of demand for dairy products in Argentina [51].

FIGURE 17. Projected Brazil Exportable Milk Surplus, 2015: Sensitivity to Milk Production Growth

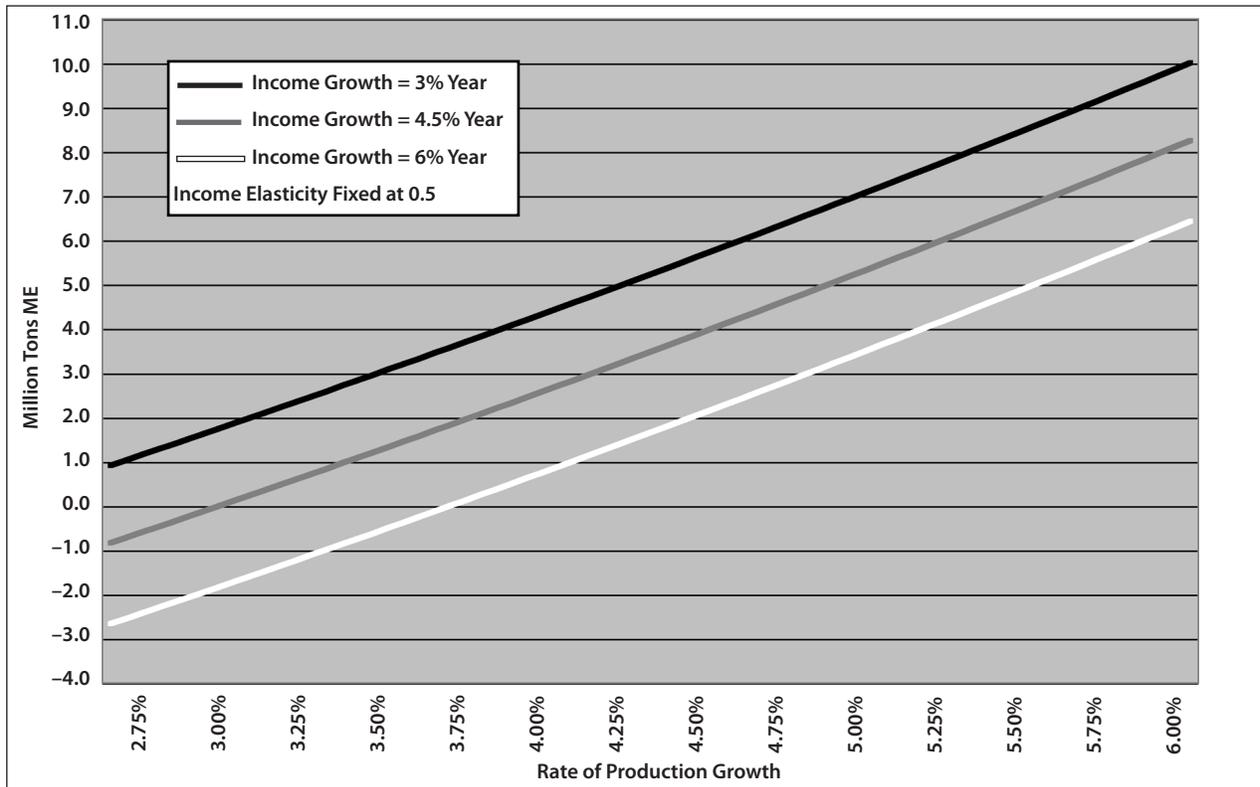
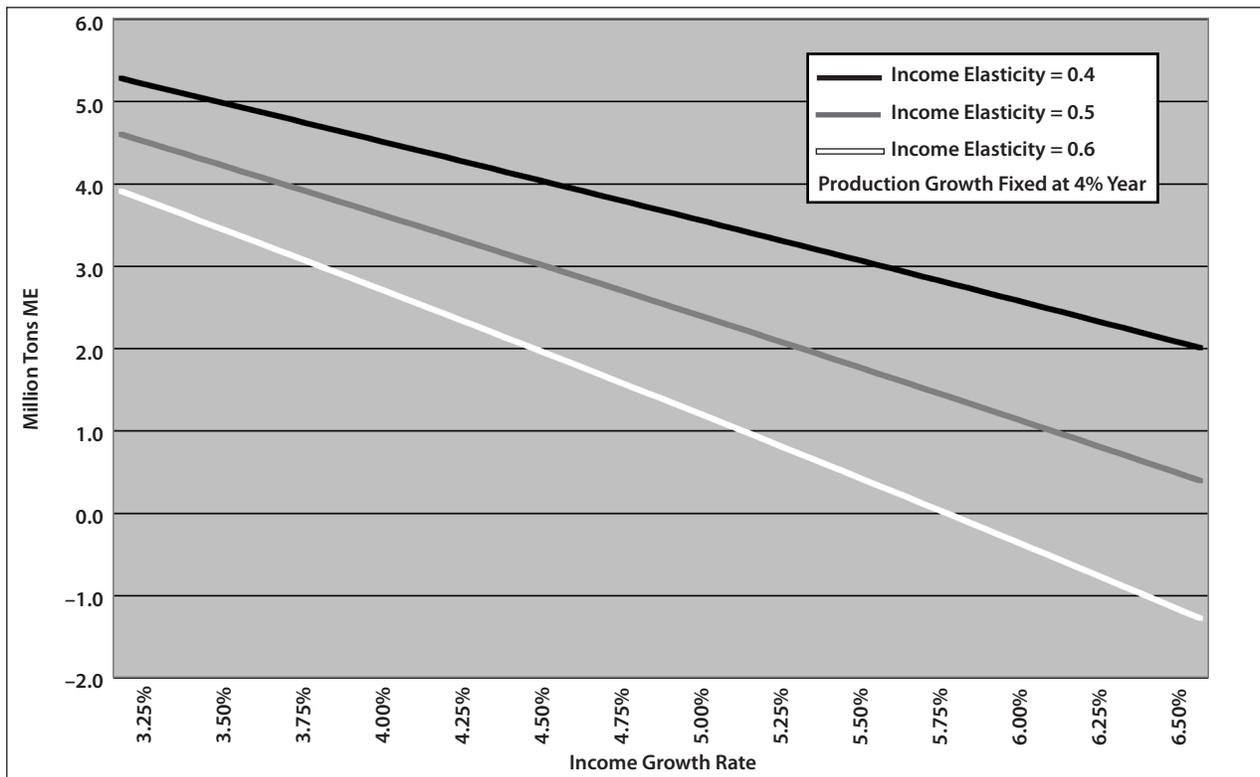


FIGURE 18. Projected Brazil Exportable Milk Surplus, 2015: Sensitivity to Income Growth and Elasticity



dairy products. This leaves the effect on exportable surplus uncertain.

Synopsis

Sorting through the internal strengths and weaknesses of Brazil's dairy sector and evaluating external opportunities and threats leads us to conclude that milk production will grow at the rate of about 4 percent per

year in the near-term. How much of this added production will be consumed internally and, as a result, how much Brazil will increase dairy exports is less clear. However, a continuation of recent consumption trends suggests Brazilian dairy exports in the neighborhood of 4 million tons milk equivalent in 2015. This would significantly elevate its standing among leading dairy exporting countries.

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